Design Engineering

FIVE DOLLARS A YEAR

NICKEL PLATING BY CHEMICAL REDUCTION (p. 59)

Measuring pressure (p. 52)

Cerametallics (p. 62)

april 1957

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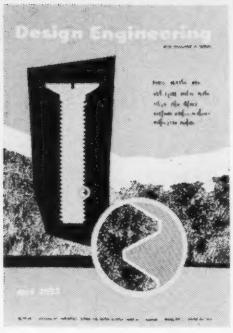

Design Engineering

VOL. 3 APRIL 1957 NO. 4

This month's cover

For a vestpocket biography of the artist who did our April cover for us see the man with a handful of paintbrushes on the next page. He is Gerald Bern who has done several covers for the magazine recently. Subject of his April offering is the feature article on electroless nickel plating which can be found on page 59. He shows a threefold view of the plating on a bolt.

Design Engineering

MEMBER

CCAB

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CONTENTS

Features

How do they make eyesaving spectacles? 47

Can pressure be measured accurately? 52

Nickel plating by chemical reduction 59

Ceramics adapt to the friction field 62

Britons give us a new aluminum bronze 67

Short features

New airliner to fly the Canadian skies in 1960 51

A new weld invades the world of chainmaking 58

Why use a high tensile bolt? 65

Departments

Design news in pictures 56, 57

Editorial 96

Ideas round-up 68, 69, 78, 80, 82, 92

Letters from readers 89

New products 73, 74, 76

People 45

Reports 5, 6

Society column 91

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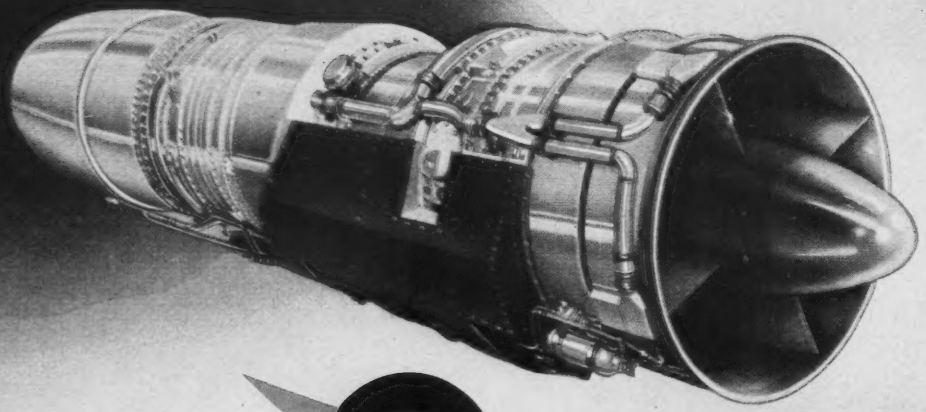

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In our next issue

In recent years a group of silicon carbide refractories have emerged that merit careful attention from the design engineer. Article on these refractories coming up in May. Also slated for May are articles on brazing stainless, drop testing, far infrared heating, 3-phase rectification and the usual monthly department pages.

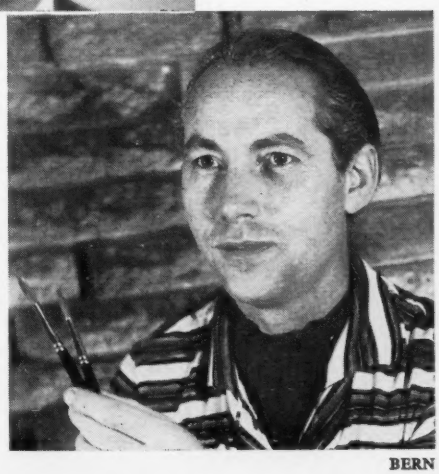
U. O. Cunard is Austrian-born and Vienna-educated. When Hitler put a stop to his business in 1939 he moved to England and on to Canada and Sperry Gyroscope in 1952, where he now heads pressure instrument engineering. He's a keen and expert hunter as well as an ardent "do-it-yourself" man. See page 52.

CUNARD

Fred W. White, English by birth, is opthalmic laboratories supervisor and production manager for the Imperial Optical Co. He has 28 years in optics behind him and did much work on prisms and lenses for the forces in World War II. A well-known lecturer to professional groups, he plays golf and bridge. See page 47.

WHITE

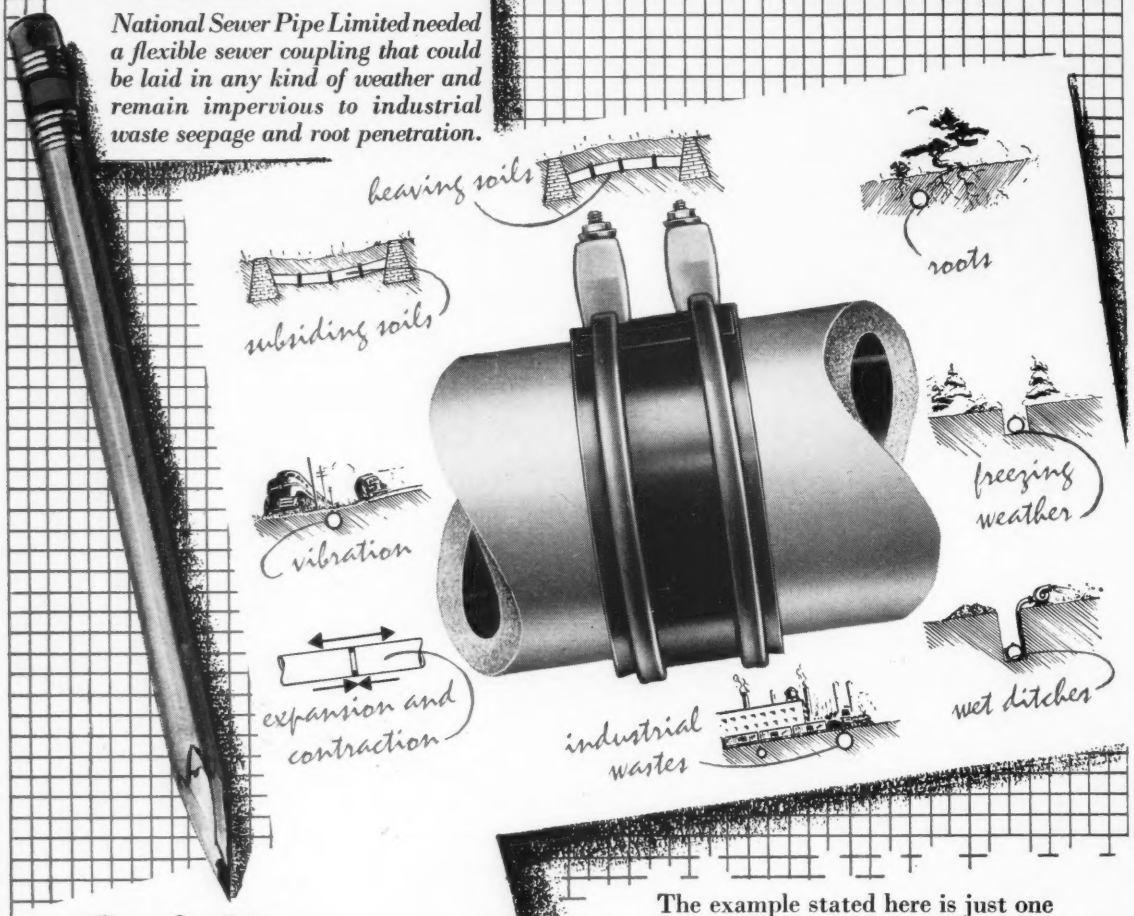
Gerald Bern was born in Roumania of Austrian parents and attended an art school in Berlin. He was art director for a movie company and a cosmetic company in his country of birth and had a studio in Bucharest for a while. He came to Canada in 1950 where he was art director for Provincial Paper. He now freelances and, among other things, does some Design Engineering covers.



BERN

Problem

National Sewer Pipe Limited needed a flexible sewer coupling that could be laid in any kind of weather and remain impervious to industrial waste seepage and root penetration.



Solution

They chose Polysar Butyl 301. This special type of Polysar has high resistance to ozone, water, heat and cold—remains constantly flexible—and gives a pressure-tight fit unaffected by either sewage or soil attack.

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Reports

News in brief from the world's producers

Arrow is the name

Avro's CF-105 has been officially named the Arrow. Power for this supersonic interceptor will come from two Orenda Iroquois turbojets. President and general manager Fred Smye said, "The name was decided upon jointly by the **RCAF** and **Avro Aircraft,** and was chosen because it is symbolic of the missile concept of the aircraft and its general arrowhead configuration."

Big lift

One of Britain's aircraft, a four-engined freight carrier, the **Blackburn "Beverley,"** recently completed a freight rescue mission north of Edmonton for a mining company.

Four huge generators had arrived from the manufacturers in eastern Canada too late for the barges which were frozen up. It was no problem for the "Beverley" which has big clamshell doors that open to 10 ft. by 10 ft. The plane can carry 22 tons of freight.

Super ceramic

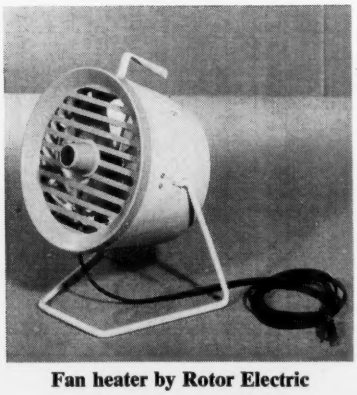
A British firm is introducing **"Hylumina"** ceramic into Canada for industrial application. Previously this material has been used extensively for the insulators of high grade racing spark plugs and igniter plugs for jet engines. The world's land, air and water speed records were all achieved with spark or igniters using "Hylumina."

Canadian pilots share trophy

Two Canadian pilots are among the nine British aircrew who have been awarded the **Johnston Memorial Trophy** for taking part in the British Government's Antarctic Expedition in 1955-56. One of the winners, James N. H. Greenshields, of Oshawa, chief check pilot of Kenting Aviation Ltd., and the Photographic Survey Corp. of Toronto, captained one of two Canadian Canso amphibians which last year started a 60,000 square mile aerial survey of the Grahamland Peninsula for the U. K.

The other Canadian honored is his co-captain in the Antarctic last year, Lew Terry of Toronto.

The Duke of Edinburgh will present the trophy at the annual banquet of the Guild of Air Pilots and Air Navigators in London on April 3.



Fan heater by Rotor Electric

Washing with sound

Production is beginning in the U. K. of a novel washing machine that uses sound vibrations to "shake" the dirt off clothing. It will be available to all overseas markets.

A simple electro-magnet causes vibrations in the washing liquid—which contains soap or detergent—in all dimensions simultaneously and at relatively high frequency. It both washes and rinses clothes and gives a maximum effect to the chemical action of the soaps or detergents.

Fifty-four awards

The **NIDC** has announced the 1957 Design Award winners. In this sixth annual program fifty-four awards have been granted by the judges. Over 600 items were submitted.

Of the winners only eight are of foreign design. Year by year the percentage of foreign designed articles has decreased and the quality of the Canadian designed items has increased. Two of the award winners are shown on this page and one on the following page.

Industrial show in Toronto

Production equipment having application in the automation processes being adopted by Canadian industry and machines never seen in Canada before, will feature at the **Industrial Tool and Production Show of Canada.** The national show, sponsored by the Canadian Council of Foremen's Clubs, will be presented for the first time in Toronto May 6-10.

Heavy water reactors

Recent studies of designs for large atomic power stations suggest the possibility that the heavy water moderated reactor might, within ten years, show a cost advantage over the gas-cooled, graphite moderated reactor and maintain this lead for many years. This is the expressed opinion of Dr. W. B. Lewis, vice-president, research and development, **Atomic Energy of Canada,** in a speech to the fifth conference on Atomic Energy in Industry at Philadelphia.

Going straight up

A fully automatic vertical conveyor with a wide application in industries requiring movement from one floor to another has been invented by **George W. Carr** of Fort William, Ontario.

The Carr machine is unique in that it can cope with both upward and downward traffic and requires only six square feet of floor space.

Qualification for technicians?

The executive council of the **APEO** recently approved a plan to establish standards of qualification for engineering technicians, as opposed to professional engineers, and also set up a system of voluntary registration for them.

The engineering technicians would be examined by the association and classified in four grades which would be determined by their educational qualifications and technical experience.

Just like the real thing

CPA will become the first Canadian airline to acquire a full flight simulator. The DC-6B simulator built by **Canadian Aviation Electronics** (the first such machine in Canada) will be installed in a special training centre at CPA's Van-

Chaput and Dorion designed cabinet

Continued overleaf ▸

couver airport headquarters where it will allow a 50% increase in effective training time for all flight crews.

The simulator accurately reproduces the characteristics of the DC-6B in flight and on the ground, of its power plant, fuel, electrical and radio systems, its instruments and propellers. In addition, there will be the realistic reproduction of sounds according to the various aircraft manoeuvres.

Golden anniversary

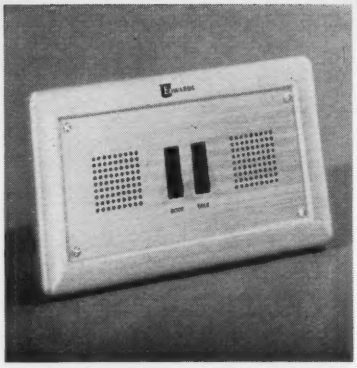
Rudel Machinery Co. is celebrating its fiftieth year of business. This family-owned company, founded by the late Clarence M. Rudel in 1908, is now in the hands of the three sons of the second generation, Jack, Thomas and William. They have incorporated a company in the U. S. and built up branches of the Canadian firm right across the country.

In Canada, under the leadership of Jack Rudel, the company now has five active divisions—machine tools, small tools, materials handling equipment, welding and electronics equipment and textile machinery.

Industrial tires

A new industrial tire company has been formed in Montreal to supply and service the Canadian materials handling field.

Canadian Industrial Rubber Products Co. will manufacture and supply laminated, pneumatic and solid industrial tires, caster wheels, molded-on wheels and molded rubber parts and products.



Edwards' apartment house telephone

Long hop

Britannia G-AOVA, first of the 310 series long-range aircraft, recently touched down in Winnipeg, 11 hours and 11 minutes after leaving Prestwick in Scotland.

Block speed for the flight was 366 mph against an average headwind of 14 mph. Total distance covered was 3,800 miles and this is believed to be the longest westbound transAtlantic flight ever made by a commercial airliner.

The plane cruised most of the distance at 30,000 ft. and, on landing, had 3½ hr. fuel left—enough to have taken it on to Vancouver.

Helping the U. K. to automate

Standard-Modern Tool Co. Ltd. of Toronto have recently engineered and built two 11-station transfer machines for export to a well-known auto plant in the U. K. Also in the shipment will be three duplex trunnion machines and a two-way horizontal drilling machine. The equipment totals almost a million dollars in value.

Machines outdo our linguists?

Linguists who spend long years mastering a half dozen languages may soon find machines bidding for their jobs.

Canadian director of the **IRE,** Allan Oxley, says ". . . it is an adaptation of the calculating machine which enables a person to talk into a microphone and have the machine type out his speech on paper . . . ultimately it will be possible for a speech in one language to be typed simultaneously in other languages."

One-day conference

Over 400 engineers attended the **Natural Rubber Development Board's** recent one-day conference "Rubber in Engineering" at the Institution of Electrical Engineers, Savoy Place, London, W.C.2.

The conference took the form of separate discussions on five papers.

NEXT MONTH IN DESIGN ENGINEERING

MAY

Refractories — In recent years a group of silicon carbide refractories have emerged that merit careful attention from the design engineer.

Far infrared heating — More and more, far infrared ovens are replacing convection ovens and infrared oven lamps. This article explains why.

Brazing stainless — Details are given of a group of high temperature brazing alloys.

Drop testing — For finding the dynamic performance characteristics of a shock absorber-tire combination.

3-phase rectification — Some aspects of the subject are explained.

Vane pump — Description of a series of balanced vane hydraulic pumps for continuous 2,000 psi service.

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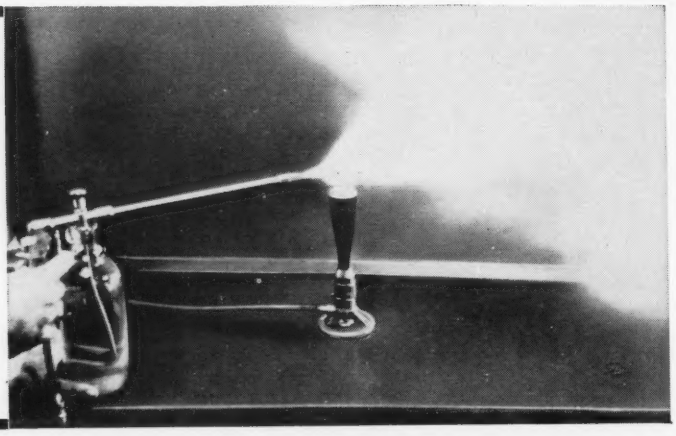
flame tests prove its fire-snuffing ability

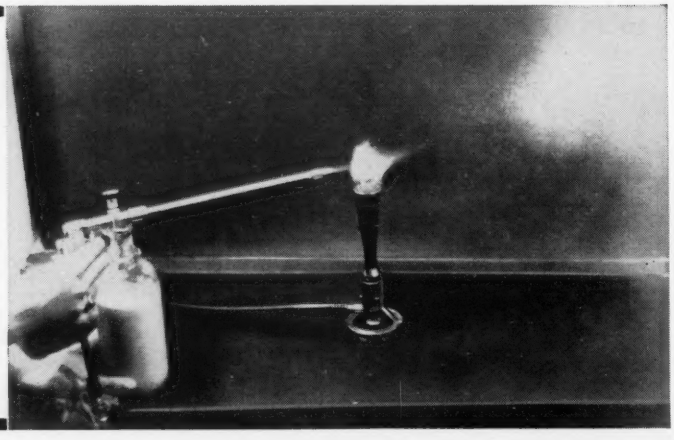
Instant combustion with ordinary hydraulic oil

This dramatic photo shows the flammability of a conventional hydraulic oil. Instant combustion takes place when it is atomized over a Bunsen burner.



No combustion with Shell Irus Fluid

Shell Irus Fluid 902 now replaces the conventional oil. Note that, in this test, there is no ignition. Shell Irus Fluid 902 resists the flame.



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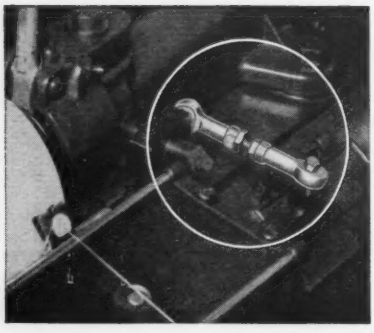
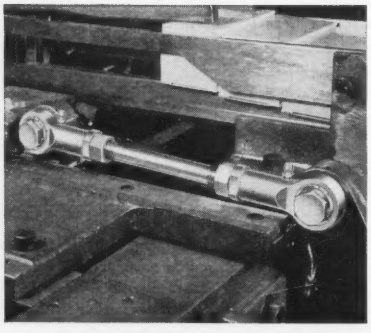
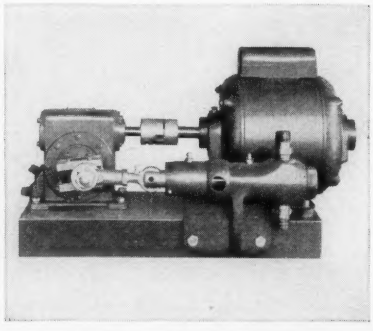
Heim Unibal Rod Ends are self-aligning, they reduce friction and lost motion, and they are economical in price and in installation time.



A short length of rod, threaded at both ends to fit two Heim Unibal female rod ends, is used on this Foster Machine Co. Model 75 pineapple coning machine. This machine is used for winding nylon, and rayon yarns to packages for use on full fashion knitting machines.



A longer length of rod, with two Heim Rod Ends locked in position with hex nuts, actuates the feed on this cartoner made by R. A. Jones & Co. Jones Constant Motion Cartoners handle millions of bottles, jars, tubes, etc. every day in a wide variety of packaging.



A male Heim rod end screwed into a female rod end forms the short linkage necessary on this Milton Roy pump. The self-aligning feature of Heim Unibal corrects the misalignment between the crank arm and the plunger moving in the pump frame.

The Heim engineering department will be glad to assist in solving your linkage problems. The Heim catalog should be at your fingertips. Please write.

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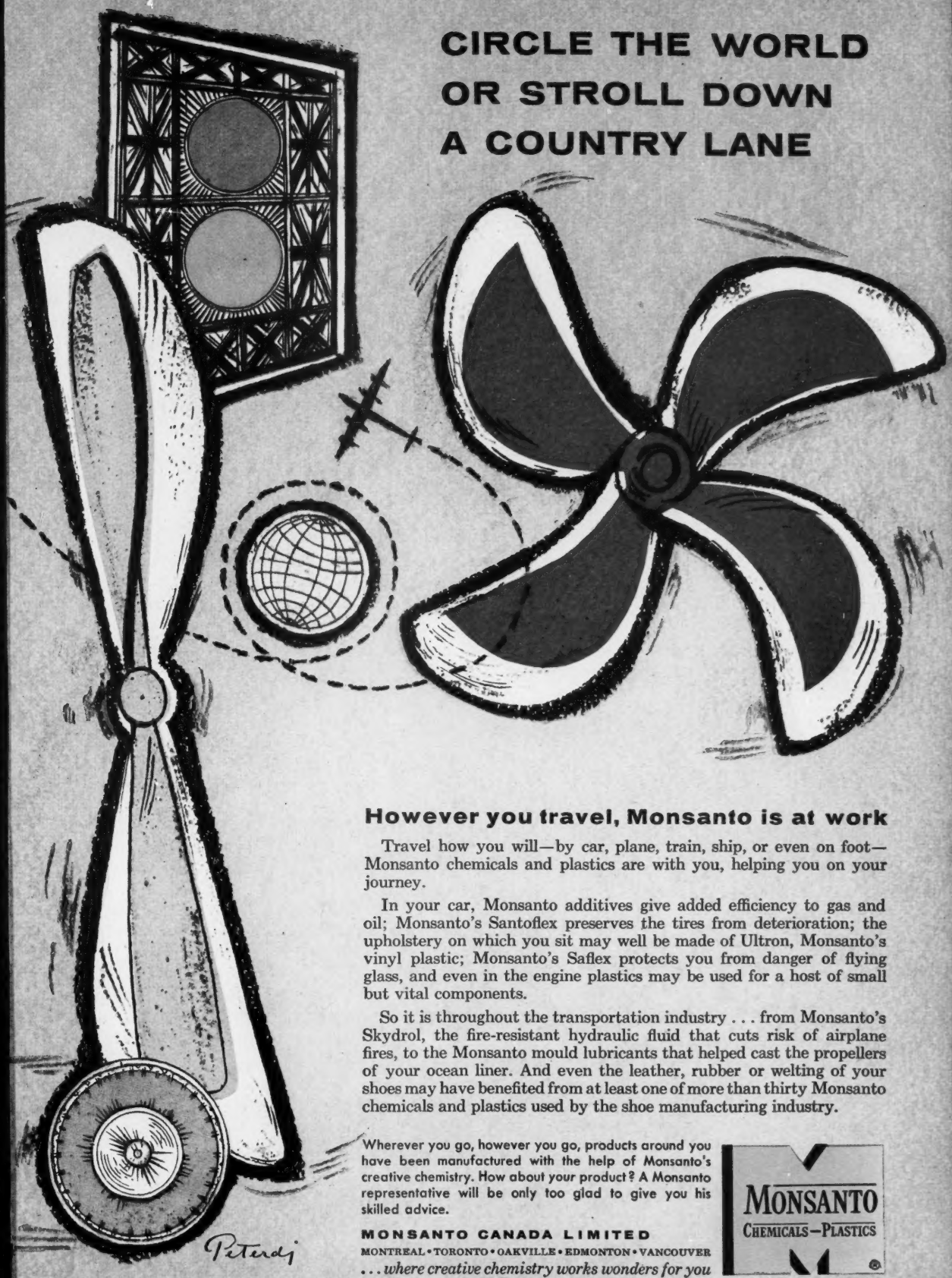

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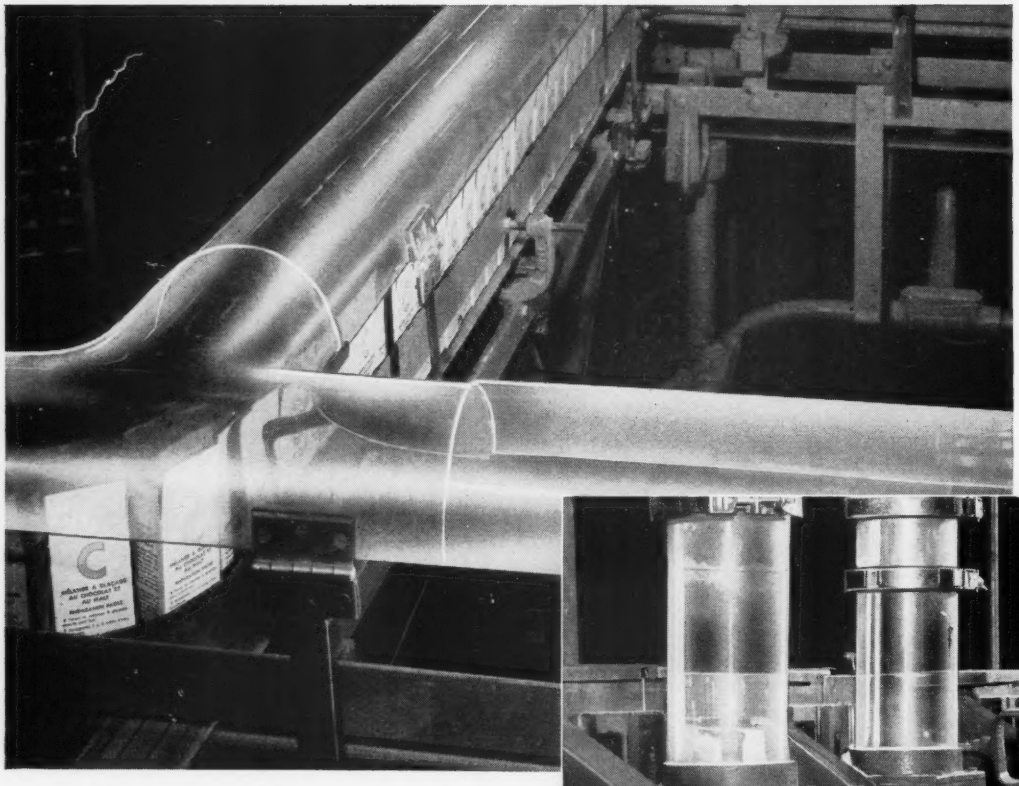

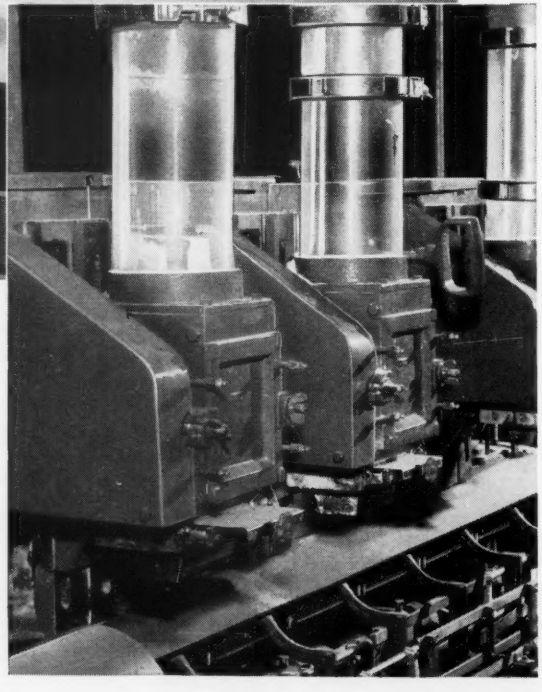

These photographs taken at the General Mills (Canada) Limited plant in suburban Toronto, show Plexiglas at work in industry.

These covers on the cake-mix filling line allow the operators to constantly check the packages, while dust is kept confined to a small area. The Plexiglas down-pipes allow the operator to see that the cake-mix remains free-flowing at all times.

This is but one example of Plexiglas at work, designed by the engineers at General Mills (Canada) Limited.

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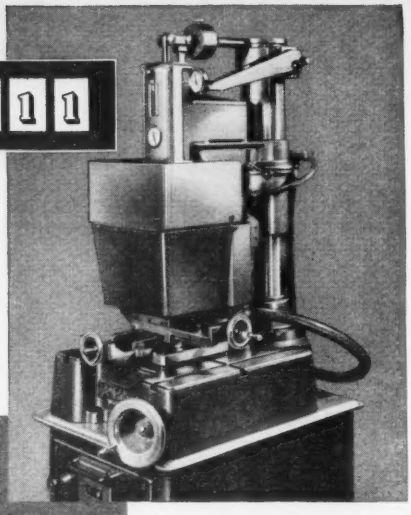
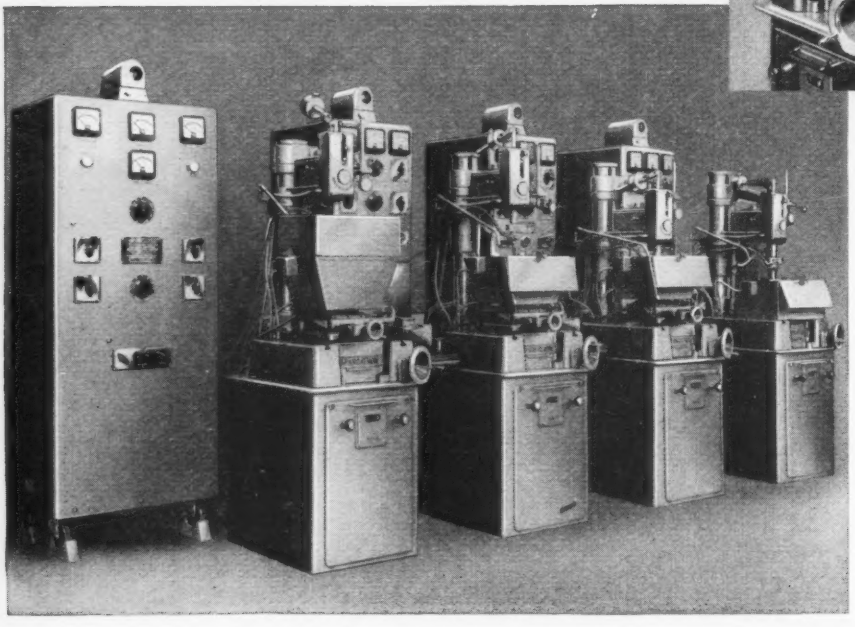
SPARCATRON Mk. III

6.5kW



The greatest advance since SPARCATRON established spark erosion machining on a commercial basis



Up to four spark-heads can be operated from one control cabinet. The current is automatically cut off when the electrode has penetrated the workpiece to a predetermined depth allowing one operator to supervise a number of heads.

CAPABLE of operating three to eight times as fast as the Mark II model, depending on the type of material and finish required, the latest SPARCATRON spark erosion machine, Mark III, has exceptional accuracy and increased capacity. The new design also features ease of access for loading the table and setting the servo-head and the facility for quick and accurate alignment of the electrode. SPARCATRON affords the best means of "cutting" intricate shapes, profiles, forms, or impressions in both hard and soft current-conducting materials.

SP5

SPARCATRON

Pioneered and established in the toolmaking industry for spark-machining and reconditioning press tools and dies and wire drawing and extrusion dies in cemented carbides and hardened steels. There are extensive applications for "cutting", reconditioning or altering flat and tangential form tools and similar components.

AVAILABLE FOR EARLY DELIVERY

B.S.A. TOOLS LTD.

228 NORSEMAN ST. TORONTO 18

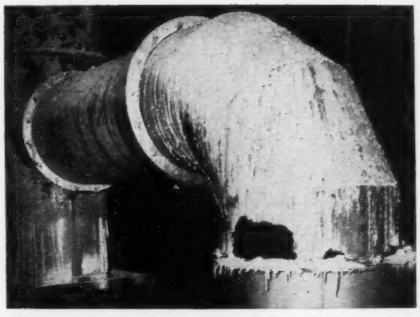
'PHONE BE. 3-1209

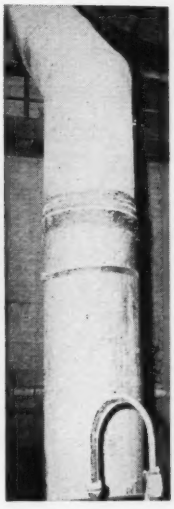
CYANAMID

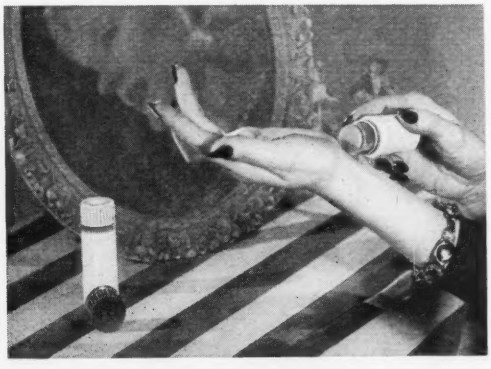
PLASTICS NEWSFRONT

THREE YEARS IN CORROSIVE SERVICE WITHOUT MAINTENANCE

That's the record established by reinforced LAMINAC® polyester resin in venting service on alum digesters at Cyanamid's Warners plant. The carbon steel breech (left) in an alum evaporator required frequent maintenance, failed after less than three year's service. Glass-reinforced LAMINAC stacks (right) in even more severe alum digester service, have needed no maintenance in more than three years. The LAMINAC units cost less in the long run, and were easier to erect and assemble, using either telescope joints wrapped and polyester-welded on the site, or flange-type joints.





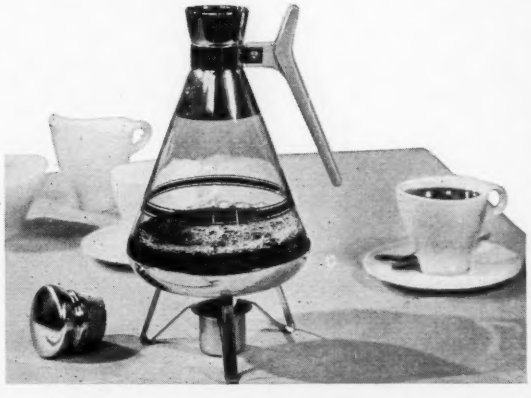


ATTRACTIVE, AIRTIGHT CASE FOR STICK COLOGNE

Six new scents of Avon Stick Cologne are packaged in smartly styled, practical cases molded of BEETLE® urea molding compound. Cases have a white base with contrasting closures in a different color for each scent. Airtight, the BEETLE case stops evaporation of the cologne. Yet the closure opens easily, and with a twist of the wrist the stick pops up for use. The case resists alcohol, essential oils and chemicals as well as staining from perspiration and grime, which wipe off easily.

FUNCTIONAL HANDLES GRACE CARAFES

Any dining or buffet table would be graced by this attractive carafe with its stylish, beige-colored handle molded of CYMEL* melamine molding compound. Elegance and function are combined in the handle, balanced for easy, comfortable pouring. Harmonizing with the carafe's gold decoration, the molded-in color won't chip or wear off. In keeping with its function, CYMEL is exceptionally strong, resistant to heat and flame, and stays cool even when the carafe, made by Club Aluminum Products Company, is full of hot coffee. *Trademark

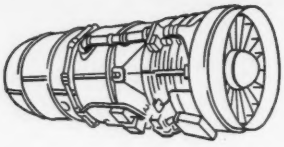


50 CYANAMID 1907 1957

NORTH AMERICAN CYANAMID LIMITED
PLASTICS AND RESINS DIVISION
160 BLOOR STREET EAST, TORONTO 5, ONTARIO

CYANAMID Plastics and Resins Division
MATERIALS FOR TOMORROW

You get extra WEAR RESISTANCE



with Flame-Plating by Linde

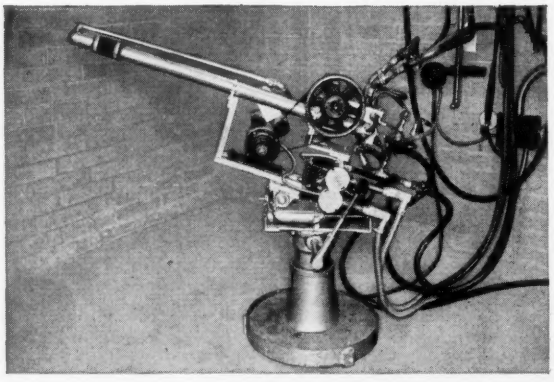
Trade Mark

Flame-Plating — a remarkable detonation process — is now being used to coat metal parts with a thin coating of tungsten carbide or aluminum oxide. Results from experience with parts in actual use show that Flame-Plating solves many problems of wear, abrasion, and fretting corrosion.

The temperature of the part being coated seldom exceeds 400-deg. F. Precision parts can therefore be Flame-Plated without risk of changes in their metallurgical properties or physical dimensions. Practically all metals can be Flame-Plated—steel, copper, aluminum, magnesium, molybdenum, titanium. Coatings of tungsten carbide and aluminum oxide can be Flame-Plated in thicknesses from .002 to .010 inch, and finished to 0.5 microinches rms.

Flame-Plating applications have been proved in service. Parts for aircraft and rocket power plants, hydraulic systems, and heating units, as well as various types of plug and ring gages, bearings and seals, and dies have had their useful lives considerably extended—economically—by Flame-Plating.

Find out how Flame-Plating can help to improve your own product. Request a copy of the free booklet, "Flame-Plating," F8065. Address "Flame-Plating, Department A."



The Flame-Plating gun consists mainly of a barrel and a mechanism for loading precise amounts of powder and gases into a firing chamber. The powder remains suspended in the explosive gases until a spark ignites the mixture, producing heat and pressure waves of tremendous force. The molten particles are hurled with supersonic velocity against the workpiece where they fuse and build up until the desired thickness is obtained.

LINDE AIR PRODUCTS COMPANY

Division of Union Carbide Canada Limited

40 St. Clair Avenue East UCC Toronto 7, Ontario

Montreal Winnipeg Edmonton Vancouver

"Linde" is a registered trade mark.

Flame-Plating by Linde

DUPONT CANADA

PRODUCT ENGINEERING NEWS

PROPERTY AND APPLICATION DATA ON THESE VERSATILE ENGINEERING MATERIALS: "ZYTEL," "ALATHON," "TEFLON," "LUCITE."

Elevator Sliding Door Hangers Moulded of "ZYTEL" Nylon

Toronto Plastics Helps Turnbull Elevators to Obtain Better Operation at Lower Cost

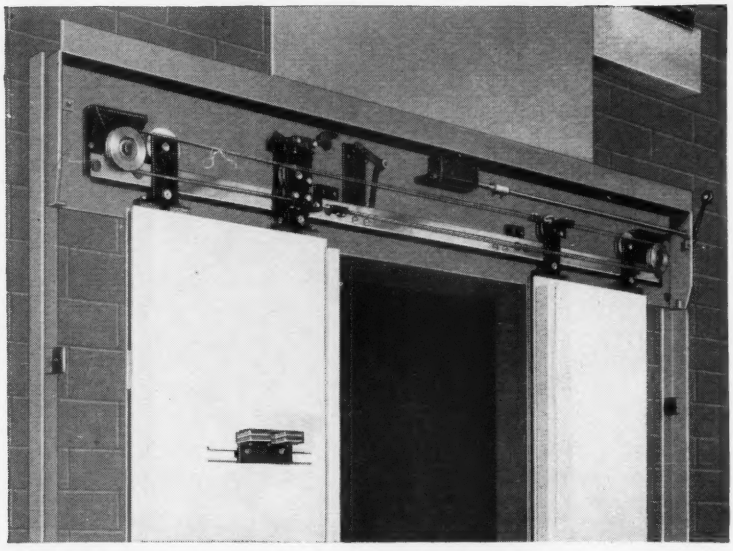
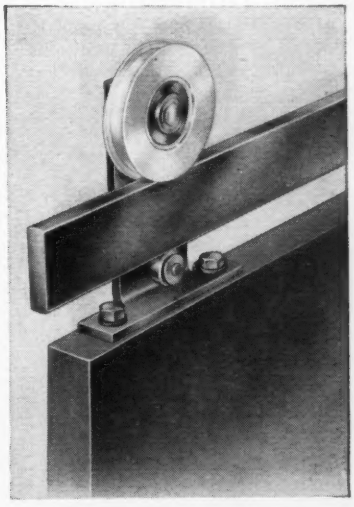


Illustration shows a Turnbull "Quiet-Glide" hanger installation for centre parting doors, with the hanger cover removed. On multi-panelled installations, these assemblies are provided with special roping devices to keep the door panels moving in proper relation to one another. "Quiet-Glide" hangers are also available for all single-speed and two-speed sliding doors.

HANGERS for horizontal sliding elevator doors require a high degree of rugged construction combined with extreme operating ease. Using wheels, or sheaves, of tough abrasion-resistant "Zytel" nylon resin, Turnbull "Quiet-Glide" door hangers have established a new standard of efficiency for this type of application. "Zytel" was chosen for this assembly because of the remarkable engineering qualities of this versatile plastic resin. Even when in continuous use, it ensures reduction of track wear, long life, as well as smooth, silent and reliable door operation.

SEALED ball-bearing nylon sheaves surmounting the Turnbull "Quiet-Glide" track assembly and measuring three and a half inches in diameter, travel along the special high-strength steel tracks which carry the door panels to the "open" or "closed" position. The steel roller below the track absorbs any upthrust on the door panel and is mounted eccentrically to permit easy adjustment of sheave-to-track clearance.

THE USE of "Zytel" permits the sheaves to revolve easily on sealed, permanently lubricated ball bearings. No track lubrication is needed and the bearings are completely protected from dirt, grit and other abrasive matter capable of reducing drastically the life of this part. A steel cover, fitting completely over hangers and track,



is also provided in the hoistway. The nylon moulding was done for Turnbull Elevator by Toronto Plastics Limited, 309 Pharmacy Avenue, Toronto, Ontario, one of Canada's most experienced producers of plastics for engineering.

OVER

DU PONT CANADA

PRODUCT ENGINEERING NEWS

PROPERTY AND APPLICATION DATA

ON "TEFLON" TETRAFLUOROETHYLENE RESIN

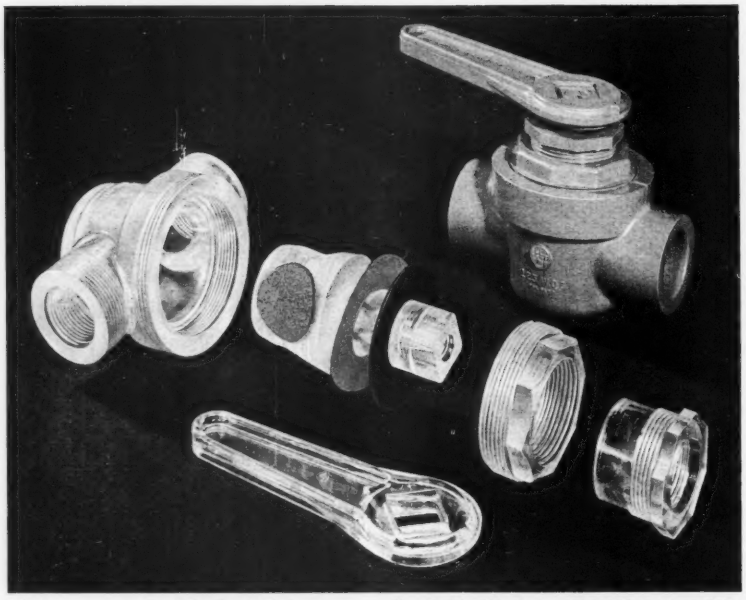
Chemically inert Du Pont TEFLON* requires no lubrication—solves problem in new plug valve

BEARING buttons of TEFLON tetrafluoroethylene resin make this unplasticized pvc plug valve, used in piping corrosive fluids, permanently "self-lubricating". A seal of TEFLON is used on the valve shaft to prevent external leakage. The exceptionally low coefficient of friction of TEFLON ($f = .04$) assures ease of turning and prevents seizing and galling.

The buttons are designed as inserts in the valve spindle. In the closed position, the buttons provide a chemically inert block across the open diameter of the pipe. This valve has been operating for more than a year in concentrated HCl at room temperature. The user reports that no problems of sticking or lubrication have occurred at any time so far.

TEFLON resists all chemicals normally encountered in industry. Exceptions to this include attack by the alkali metals under certain conditions. At elevated temperatures and pressures, halogens and certain halogenated chemicals and solvents may affect TEFLON.

Du Pont TEFLON remains tough over a wide temperature range. It has no water absorption. Sticky or viscous materials do not adhere to its waxy surface. It is specified for electrical uses because of a high dielectric strength and extremely low power factor. The combination of these properties gives TEFLON unique design possibilities in a broad range of applications.



Vital components of Du Pont TEFLON are utilized in this polyvinylchloride plug valve manufactured by Tube Turns Plastics, Inc., Louisville, Kentucky. Exploded view of the valve is based on a transparent mock-up made from Du Pont LUCITE® acrylic resin.

It may pay you to investigate Du Pont TEFLON for use in your own application. For data on this outstanding engineering material, available to you without cost or obligation, clip and mail the coupon at left.

DU PONT COMPANY OF CANADA (1956) LIMITED,
CHEMICALS DEPARTMENT, P.O. Box 660, Room A-4, MONTREAL, QUE.

DE-4

Please send me more information on the Du Pont plastic engineering materials checked: ☐ *"Zytel"*; ☐ *"Alathon"*; ☐ *"Teflon"*; ☐ *"Lucite". I am interested in evaluating these materials for*

_____

NAME_____ POSITION_____

COMPANY_____

STREET_____

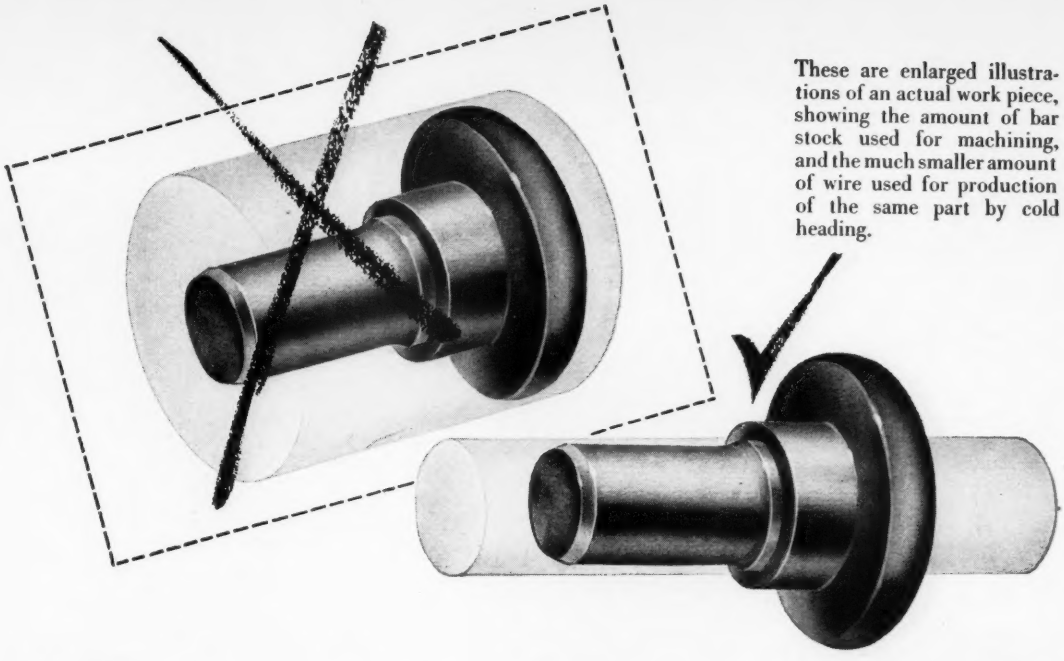
CITY_____ PROVINCE_____

TYPE OF BUSINESS_____

*"Alathon", "Lucite", "Teflon" and "Zytel" are registered trade-marks of E. I. du Pont de Nemours & Co. (Inc.)

TEFLON is a registered trademark...

TEFLON is the registered trademark for Du Pont tetrafluoroethylene resin, and should not be used as an adjective to describe any other product or any component part; nor may this registered trademark be used in whole, or in part, as a trade name for any product.



These are enlarged illustrations of an actual work piece, showing the amount of bar stock used for machining, and the much smaller amount of wire used for production of the same part by cold heading.

Why pay for metal you can't use?

Compared with other production methods for parts involving contours and special shapes, cold heading offers faster output, lower unit costs, and a high degree of uniformity in quality and dimensions.

On Stelco's modern Cold Heading equipment, wire up to 1″ in diameter, of any forgeable metal, can be upset to 4½ times its original diameter with virtually no scrap . . . effecting a self-evident saving in material over methods involving the machining down of heavy bar stock. Secondary operations — such as threading, punching, bending, or shaving — can be added economically if desired.

The possibilities of economy and product improvement offered by Stelco's Cold Heading technique are relatively new. Why not investigate their application to *your* operations? Any Stelco Sales Office will co-operate promptly.

STELCO **COLD HEADING**

can save up to 67%
on the metal alone,
for contoured parts

56141.B

THE STEEL COMPANY OF CANADA, LIMITED

Executive Offices: Hamilton — Montreal

Sales Offices: Halifax, Saint John, Montreal, Ottawa, Toronto, Hamilton, London, Windsor, Winnipeg, Edmonton, Vancouver.
J. C. Pratt & Co. Limited, St. John's, Newfoundland.

TURNABOUT*

* with apologies to Thorne Smith.

Made in Canada . . . Sold in U.S.A.

Here is a Canadian Electronic Product which has built up a healthy American reputation. Welwyn Canada Limited is now one of the largest manufacturers of Deposited Carbon Resistors in the American market.

The Welwyn plant is located in London, Canada, and Canadian users of quality precision resistors can now enjoy all the advantages that result from Continent-wide distribution.

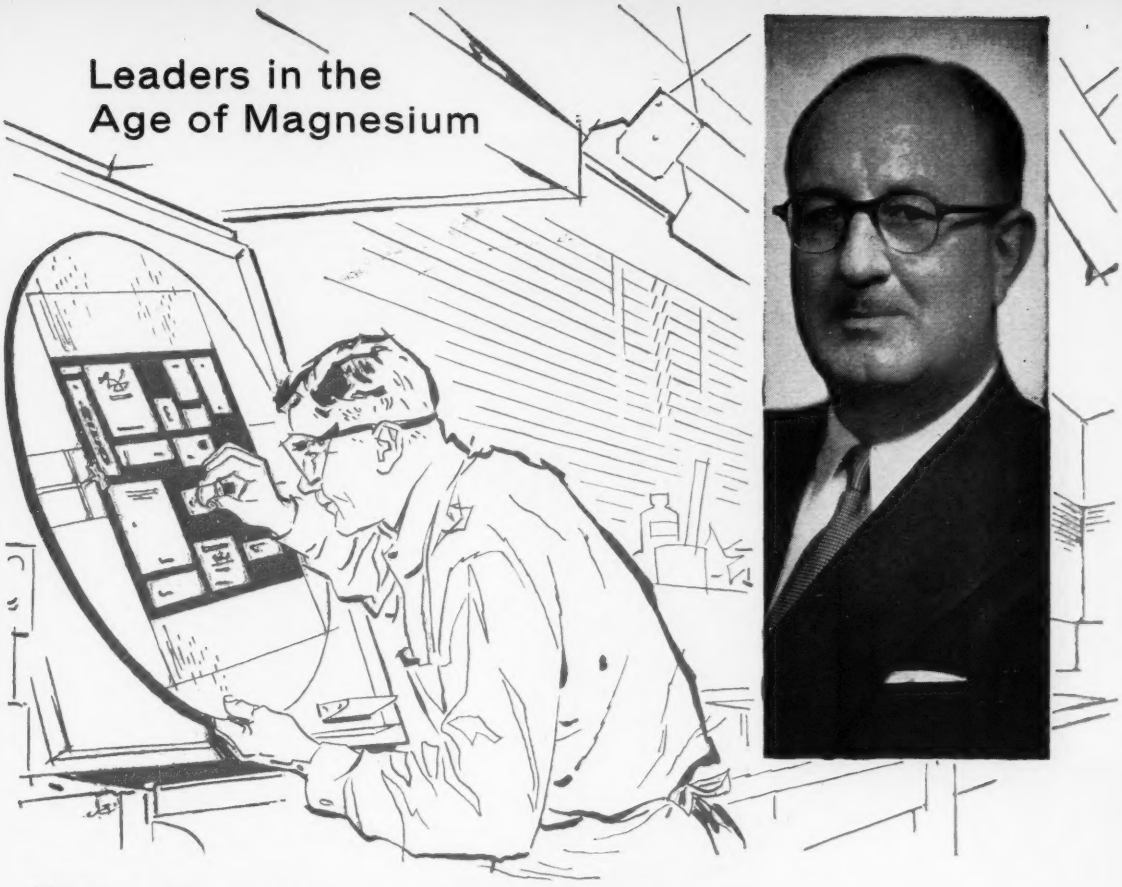
We would be pleased to discuss your requirements with you.

Welwyn Canada Limited

1255 Brydges St., LONDON, Ontario

Sold in U.S.A. through:
Welwyn International Inc., 3355 Edgecliff Terrace, Cleveland 11, Ohio

Leaders in the
Age of Magnesium



"We have based our future on

MAGNESIUM

"We at Brooks and Perkins based our future on Magnesium a good many years ago. We have prospered. We have found that Magnesium will do a job in economic competition with other materials in a hundred different ways. Not only have our fabricating plants in Detroit been expanded, but we were able to install our own rolling mills in nearby Livonia. Metal dealers warehouse our products, and we have offices in New York, Washington, Los Angeles and Dallas.

"Domal High Purity Magnesium is contributing to the success of Brooks & Perkins' Magnesium Printing Plates. Our Magplate Division tells us that its high quality and uniformity gives almost as much advantage over our earlier plates as magnesium has over other metals.

Extract from a letter by Mr. Howard Perkins, President, Brooks and Perkins Inc., Detroit, Michigan.

DOMAL
HIGH-PURITY
MAGNESIUM

THE WORLD'S LIGHTEST, MOST VERSATILE METAL

DOMINION MAGNESIUM LIMITED

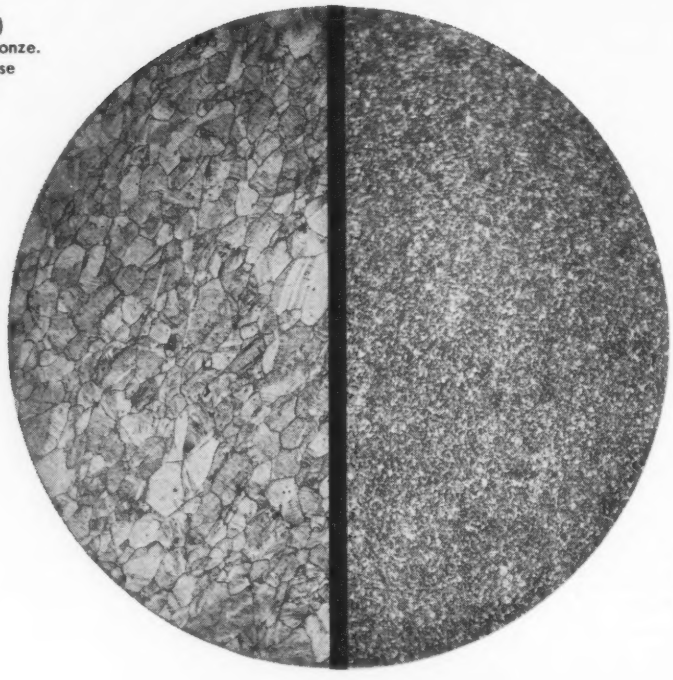
320 BAY STREET · TORONTO, CANADA

The original engravings for this advertisement were made on magnesium

DURAFLEX

developed by ANACONDA

Micrograph (75x magnification) of regular phosphor bronze. Note relatively coarse grain structure.



Micrograph (75x magnification) of Duraflex. Fine grain structure is the secret of its superiority.

This fine-grain phosphor bronze has 30% greater endurance limit

DURAFLEX is a new, fine-grain phosphor bronze developed and sold only by Anaconda. Comparative fatigue tests show that the endurance limit of DURAFLEX is approximately 30% higher than for ordinary phosphor bronzes. In surface appearance, surface smoothness and hardness, it is superior to other phosphor bronzes. It is unsurpassed in corrosion resistance by any other phosphor bronze. Further, its formability is increased with no sacrifice in yield strength. DURAFLEX is a premium phosphor bronze in every way except cost; there's no increase in price. If you're now using a hard-temper phosphor bronze, chances are that you can do the same forming in extra-hard temper DURAFLEX. For longer life in the parts you form, try DURAFLEX, by Anaconda. Write today for information on specific problems. **Anaconda American Brass Limited, New Toronto, Ontario. Sales Offices: Montreal and Vancouver.**

ANACONDA

(Trade Mark Reg'd.)

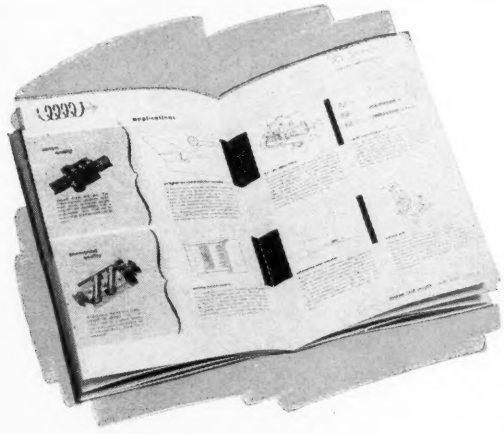
***FIRST* in Canada for Copper, Brass and Bronze**

5619

FREE! YOUR NEW ACTUATOR and SPLINE "PROBLEM SOLVER"!

New 1957 Engineering Data Book from World's Largest Producers of Ball/Bearing Screws and Splines

36 pages crammed with time-, work-, and money-saving facts: Principles • Types • Basic Operations • Coupling Methods • Efficiency • Versatility • Advantages • Selection Factors • Design Data • Sample Problems, etc.



SAGINAW b/b SCREWS are *90%-98% efficient* (compared to 15%-20% efficiency of Acme screws). Require ⅔ LESS torque and power for same linear output—with consequent weight, space reductions. Function normally at −75° to +250° F. Two types: precision-ground or commercial rolled-thread. Have been built 1½ in. to 39½ ft. long.

SAGINAW b/b SPLINES have *40 times lower coefficient of friction* than sliding splines; transmit or restrain high torque loads far better; permit vital power, weight, space reductions. Have been designed 3 in. to 10 ft. long.

SEND FOR YOUR FREE COPY TODAY

or see our section in Sweet's Product Design File

Saginaw Steering Gear Division, General Motors Corporation
b/b Screw and Spline Operation
Dept. 1W, Saginaw, Michigan

Please send 1957 engineering data book on Saginaw b/b Screws and Splines to:

NAME_____

COMPANY_____ TITLE_____

ADDRESS_____

CITY_____ ZONE____ PROV._____

Saginaw ball bearing Screws & Splines

SAGINAW STEERING GEAR DIV., GENERAL MOTORS CORP., SAGINAW, MICH.

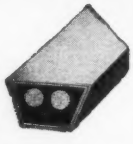
everything IN V-BELT DRIVES from one reliable source

Canadian Allis-Chalmers has both the engineering experience and a complete line of V-belt drive equipment to solve even the most unusual problems. Texrope drives feature such specific advantages as: *Magic-Grip* sheaves with "easy-on, easy-off" construction; the grommet belt which lasts 20–50% longer and costs no more than ordinary belts; and the *Vari-pitch* sheave — the low cost way to obtain variable speeds.

Regardless of the nature of the application, there's a just-right Texrope drive which will do the job with maximum efficiency and economy. For more information, contact your nearest Texrope dealer or CA-C Sales Office, or write to Canadian Allis-Chalmers Limited, P.O. Box 37, Montreal, Que.

Engineered . . . Sold . . . Serviced by Authorized Dealers Coast to Coast

TEXROPE Grommet V-belts give 20 – 50% longer life than ordinary belts, yet cost no more!



STANDARD CAST IRON SHEAVES made-to-order from stock patterns for A,B,C,D or E section belts. One to 2000 hp. Split sheave or split hub.

MAGIC-GRIP SHEAVES — with interchangeable, patented split taper bushings. On and off in a jiffy. Carried in stock for A, B and C section belts: 1 to 75 hp.

VARI-PITCH SHEAVES for standard belts provide speed variations up to 40% for drives from 1 to 300 hp. Available in stationary or motion control.

MADE IN CANADA

CANADIAN ALLIS-CHALMERS

Texrope, Magic-Grip and Vari-Pitch are Allis-Chalmers trademarks

56-TR-3

Farm implement dealers cooperated with the Watonwan County, Minn., Safety Council, to stress the dangers of unguarded power take-off shafts in this county fair exhibit. "Empty chairs" mean "empty tractor seats" too!

Photo courtesy of
Watonwan County Safety Council

BLOOD BROTHERS *Integral*

Safety-Shielded Drive Lines help farm implement dealers keep their customers safe!

For humanitarian reasons—and wise business practice as well—it pays to increase the customer's safety in every possible way. As proof of great progress in the farm implement field, Blood Brothers reports an increase of over 300% in the demand for Integral Safety-Shielded Drive Lines during the past year alone!

Some manufacturers are supplying Integral-Shielded Drives exclusively on *all* power take-off implements they build. This trend to greater safety helps implement builders—dealers—users—everyone!

Saleswise, Blood Brothers Integral-Shielded Drive Lines are helpful too. They offer a strong "plus" selling feature that *proves* you place the farmer's best interests *foremost.* Designed to avoid careless or absent-minded removal, they'll be *in place* to protect implement operators at all times.

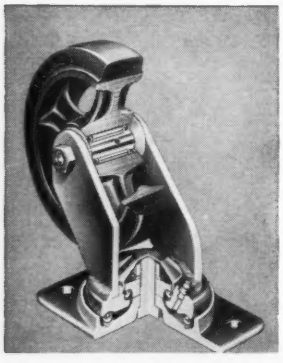
If you *build* implements, write for information on the sizes you need.

FOR FARM IMPLEMENTS, MORE BLOOD BROTHERS UNIVERSAL JOINTS ARE USED THAN ALL OTHER MAKES COMBINED

BLOOD BROTHERS
MACHINE DIVISION
ROCKWELL SPRING AND AXLE COMPANY
ALLEGAN, MICHIGAN

UNIVERSAL JOINTS
AND DRIVE LINE
ASSEMBLIES

Wear-defying Albion Casters beat this rugged grind



Another first for Albion! A sealed caster that stays sealed, eliminating the need for maintenance due to grease loss, dirt, debris, water or other foreign material. Broad range of sizes and wheel types.

THIS photograph gives you some idea how a Dragline conveyor puts platform truck casters through their paces.

At this terminal of a large trucking firm, the Dragline is almost constantly in motion—moving loaded platform trucks from receiving docks to shipping areas and returning empty trucks to the receiving docks.

Ordinary casters would soon bite the dust under this daily grind. Money saved by the low initial and operating costs of the Dragline system would be used up for casters replacements.

But these Albion Casters can take it! Load-rated Albion Casters are *engineered* for tough industrial jobs. Wear-resistant qualities keep them rolling along reliably, giving dependable service far exceeding recognized limits.

Albion Industrial Casters possess design and construction features that are valuable assets in original or replacement applications. And United Steel offers a complete range of Albion Industrial Casters . . . one that exactly suits *your* requirements.

For a copy of the Albion Industrial Caster catalogue, or advice on a caster problem, just drop a postcard to: *Dodge Manufacturing Division United Steel Corporation Limited, 58 Pelham Avenue, Toronto 9, Ontario.*

United Steel

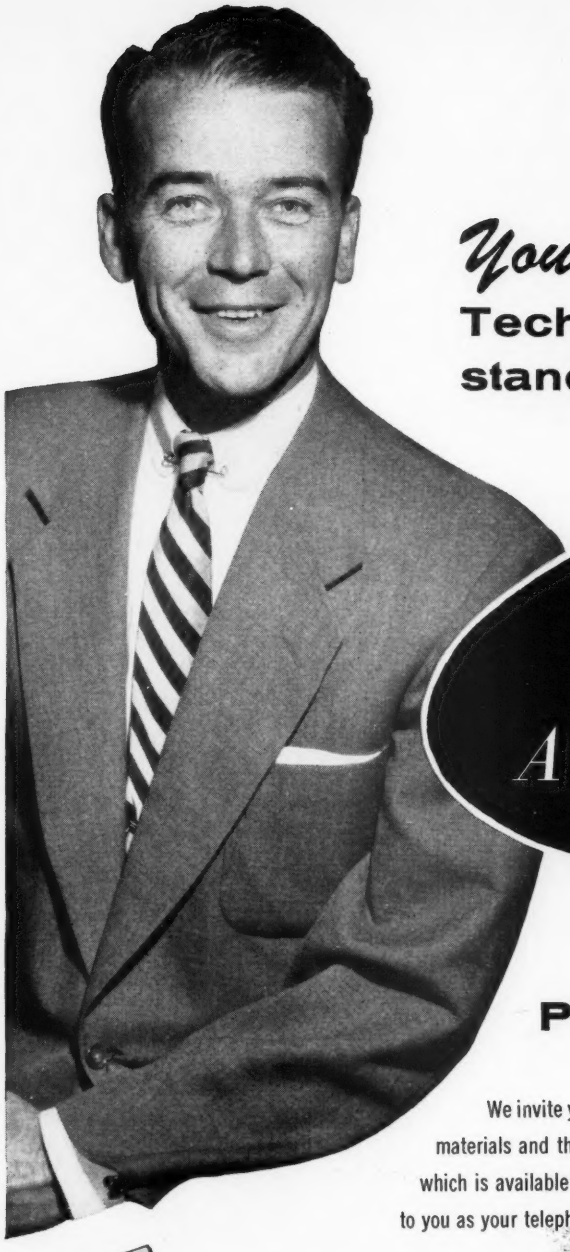
57-100

United Steel

CORPORATION LIMITED

TORONTO • MONTREAL • LONDON • GALT

WELLAND • KIRKLAND LAKE • SUDBURY



Your "BAKELITE"
Technical Representative stands ready at all times to give you

Technical Assistance

on "BAKELITE" Plastic Raw Materials

We invite you to use his services. His knowledge of plastic raw materials and their correct applications is a source of information which is available to you at any time. He is as close to you as your telephone.

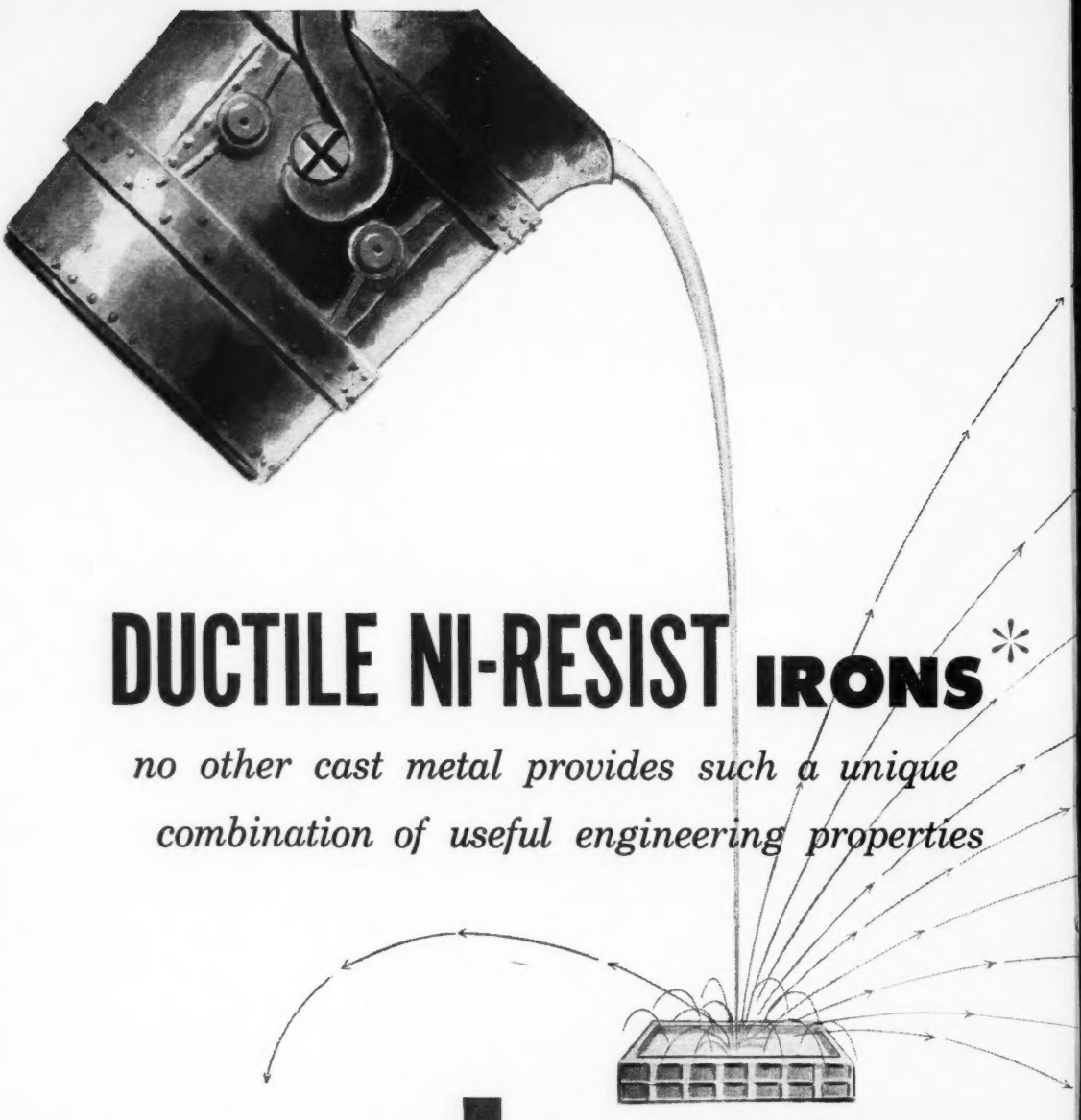
Write for booklet "1957 Condensed Reference File" (J710), outlining background data on "Bakelite" plastic raw materials and their correct selection for specific applications.

PHENOLICS • POLYETHYLENE • POLYSTYRENE • POLYESTERS • EPOXIES

BAKELITE COMPANY
A chief supplier of Plastic Raw Materials to Industry
Division of UCC Union Carbide Canada Limited
TORONTO • MONTREAL

BAKELITE BRAND PLASTICS

"Bakelite" and the Trefoil device are registered trade marks



DUCTILE NI-RESIST IRONS*

no other cast metal provides such a unique combination of useful engineering properties

ENTIRELY CI CANADIAN

* For detailed information write for a copy of "Ductile Ni-Resist". You are not obligated in any way.

Canada Iron
foundries limited
FOUNDRY AND MACHINE DIVISION

HEAD OFFICE: 921 SUN LIFE BUILDING, MONTREAL
TORONTO OFFICE: 169 EASTERN AVE., TORONTO

DN-1

Corrosion Resistance:

Acid, alkali, and salt handling problems have been solved by Ductile Ni-Resist.

Weldability:

No difficulty in welding in shop or field.

Toughness:

Impact resistance of Ductile Ni-Resist is comparable to that of steel at ordinary temperatures; an important plus is that it suffers no appreciable embrittlement at sub-zero temperatures.

Erosion Resistance:

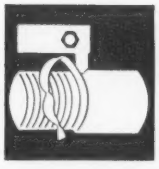
The Ductile Ni-Resist series of irons show economical service under many erosive conditions; and resistance to erosion as in a pump impeller is outstanding.

Ductility:

Ductile Ni-Resist irons possess 10 to 40% elongation in a tensile test, ample for all normal service applications.

Castability:

Good flowing quality of Ductile Ni-Resist permits the casting of intricate designs, which are difficult to produce in some other cast corrosion-resistant metals.



Machinability:

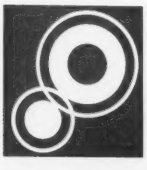
Machinability rates of Ductile Ni-Resist are of the same order as those of conventional pressure type gray iron.

Heat Resistance:

A high order of heat resistance is available with Ductile Ni-Resist up to 1300 deg. F. Certain types are recommended for service up to 1500 deg. F. Ductile Ni-Resist irons not only reduce the rate of oxidization, but also the oxidization products adhere tenaciously to the base metal.

Controlled Expansion:

Expansivities from 4.5 to 10.4 millionths per deg. F. are available with the different types of Ductile Ni-Resist.



Wear Resistance:

Metal to metal rubbing parts last much longer and perform better, especially under corrosive conditions, when made of Ductile Ni-Resist.

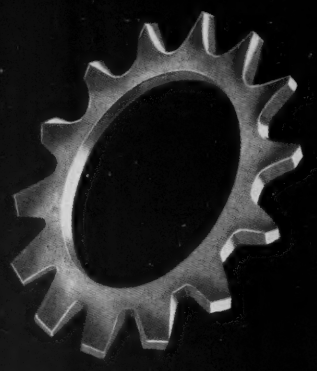
Non-Magnetic:

Some types of Ductile Ni-Resist irons are non-magnetic, and are therefore useful in many applications in the electric and allied fields where this quality, and the many others that this alloy has to offer, are required.

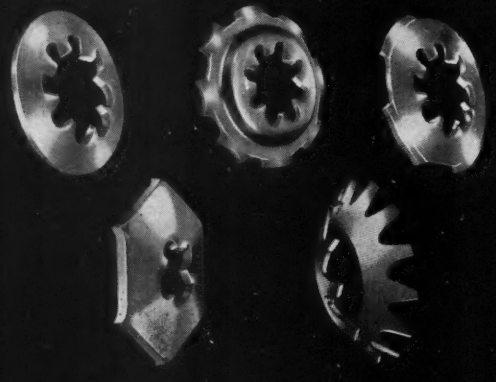
more

Locking Power

...than any other washer or washer substitute

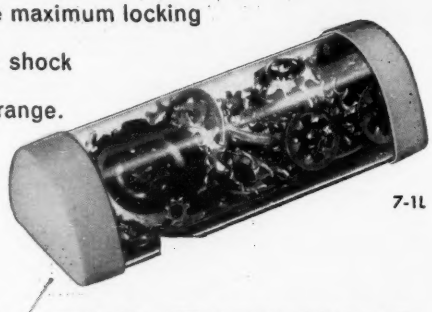


SHAKEPROOF®
Lock Washers



Shakeproof locking teeth can be incorporated into many types of lock washers . . . for added strength, countersunk, and elongated holes, heavy-duty applications and other requirements.

• Shakeproof Lock Washers assure maximum vibration protection for your product • Exclusive tapered-twisted teeth resist loosening • Assure maximum locking engagement • Form positive brace against rotation • Resist shock • Available in nearly 500 job-tailored styles and wide size range.



7-1L

Send for Shakeproof Lock Washer Sample Kit

SHAKEPROOF / FASTEX

"FASTENING HEADQUARTERS"®

DIVISION OF CANADA ILLINOIS TOOLS LTD.

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STAINLESS STEEL
CASTINGS

Shawinigan Chemicals makes a wide range of stainless steel castings — large or small, simple or intricate. Regardless of size or type of stainless steel, Shawinigan will turn out the castings needed to handle YOUR heat or corrosion problem.

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Whatever you make, there's a

WALDES TRUARC RETAINING RING

designed to save you material, machining and labor costs

basic types

BASIC

#5000 *(internal)*

#5100 *(external)*

Tapered design principle permits rings to maintain constant circularity and pressure against bottom of groove.

INVERTED

#5008 *(internal)*

#5108 *(external)*

Inverted construction provides uniform protruding shoulders while maintaining constant circularity when installed in groove.

for taking up end-play

BOWED

#5001 *(internal)*

#5101 *(external)*

Bowed construction permits **resilient** take-up of end-play.

BEVELED

#5002 *(internal)*

#5102 *(external)*

Beveled construction permits **rigid** take-up of end-play.

for radial assembly

E-RING

#5133
#5131 *(bowed)*

Radially applied. Provides large shoulder on small shaft diameter. Bowed version provides take-up of end-play.

CRESCENT

#5103 *(external)*

Applied radially over shaft. Secure against impact and vibration.

INTERLOCKING

#5107 *(external)*

Two-piece ring applied radially. Secure against extremely high r.p.m.'s and heavy thrusts.

self-locking types

CIRCULAR SELF-LOCKING

#5005 *(internal)*

#5105 *(external)*

Installed axially. Requires no groove. Recommended for permanent assemblies exposed to relatively moderate thrusts, impacts or vibrational loading.

TRIANGULAR SELF-LOCKING

#5305 *(external)*

Low cost retainer. Makes possible tight assemblies free of end-play on relatively soft shafts.

TRIANGULAR NUT

#5300 *(external)*

Flattens under torque. Secures equal load distribution. Replaces lock washer on screw.

GRIP-RING

#5555 *(external)*

Applied axially on shaft. Requires no groove. Exerts considerable frictional hold against axial displacement.

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REGISTERED TRADE MARK

RETAINING RINGS

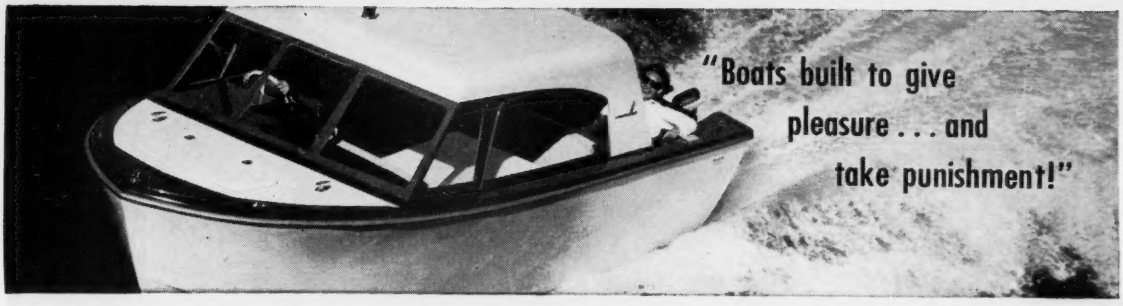
Redesign with Waldes Truarc Retaining Rings and cut costs. Wherever you use machined shoulders, bolts, snap rings, cotter pins . . . there's a Waldes Truarc Retaining Ring designed to do a better job of holding parts together.

Truarc rings are precision-engineered . . . quick and easy to assemble and disassemble . . . always circular to give a never-failing grip . . . and they can be used over and over again.

LYMAN TUBE AND BEARINGS, LIMITED

MONTREAL • TORONTO • HAMILTON • WINNIPEG • VANCOUVER

Representatives at New Glasgow, N.S.



● Bumps and bruises that would often splinter an ordinary craft are shrugged off by these sturdy boats made with RCI POLYLITE polyester resin. Plastic Fabrications, Inc., Miami, Florida, reports that the inherent resiliency of RCI POLYLITE reinforced with fibrous glass allows a hull to "give" under pressure instead of offering stiff resistance — thus improving the overall strength and safety factor of their products.

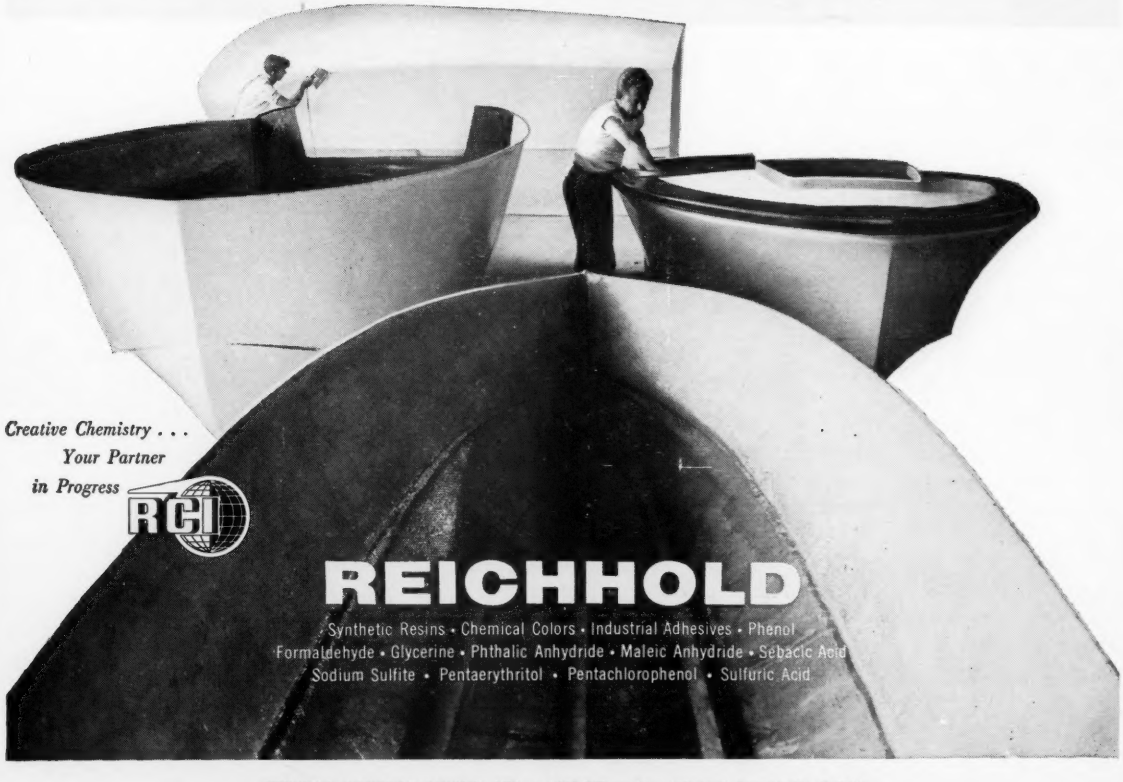
In addition, a molded boat permits more attractive and complicated hull and deck structure — usually expensive features — at reasonable cost . . . and eliminates sharp edges that are dangerous in angry waters.

"In production, our primary requirement is a base material with consistent formulation," says J. A. "Woody" Woodson, Plastic Fabrications' president, in explaining why his firm uses RCI POLYLITE. "The curing and weathering characteristics must not vary from batch to batch. If a resin does not cure, our time and labor is lost and the section must be discarded."

"Another 'plus' for Reichhold POLYLITE," continues Mr. Woodson, "is *dependable* distributor arrangements. Our POLYLITE orders are delivered *on time*, so that costly production delays are a thing of the past."

Products possessing the unique advantages possible with RCI POLYLITE — lightweight strength, durability, and easy maintenance — are becoming increasingly popular and profitable in today's market. For additional information about how RCI POLYLITE can be incorporated into one of *your* products by laminating, molding or other plastic applications, write for free ***Booklet A.***

Constructed economically with
UNIFORM QUALITY **POLYLITE** RESINS



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INVESTIGATE THESE
HIGH TEMPERATURE

NICKEL
ALLOYS

INCONEL*

WITHSTANDS EXTREME HEAT

Resists oxidation and retains good mechanical properties at high temperatures. Excellent resistance to sulphur-free heat-treating atmospheres . . . practically immune to embrittlement by carburizing or nitriding atmospheres. Ideal for food and chemical processing or heat-treating equipment and aeronautical parts.

INCOLOY*

HEAT RESISTANCE PLUS GOOD WORKABILITY

Good resistance to oxidation and other corrosive conditions; strength at high temperatures. Excellent workability and welding properties. Uses similar to Inconel at temperatures up to 1900°F. Greater resistance to sulphur attack, green rot and molten cyanide salts.

INCONEL "X"*

RETAINS ITS STRENGTH AT HIGH TEMPERATURES

Exceptional strength and hardness from sub-zero to 1500°F. High resistance to oxidation and other forms of corrosion. Excellent for moving parts which operate in corrosive environments within small clearances such as rotors and blades of aircraft gas turbines. Also used for bolts, springs and diaphragms.

NI-O-NEL*

WITHSTANDS HOT CORROSIVE LIQUIDS AND SLURRIES

Resists corrosion by hot sulphuric, sulphurous and phosphoric acid solutions. Also resists nitric acid solutions, nitrates, cupric, ferric and mercuric salts except chlorides. Considerably better resistance than stainless steels to pitting by sea water or stress corrosion cracking in chloride solutions.

These high Inco Nickel Alloys provide exceptionally good performance characteristics, particularly where extreme heat or highly corrosive conditions are a factor. In many applications they will long outlast competitive materials. The alloys shown here are available in most standard forms . . . and Inco Customer Service goes with them . . . to help you solve metal problems. Write us for complete information.

**Trade Marks*

INCO
TRADE MARK

THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED
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THE ORIGINAL EQUIPMENT MARKET EXPOSITION

and Conference

New York Coliseum May 20-23, 1957

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Watch hundreds of product demonstrations. See the widest range of materials, components, parts, fasteners, finishes, in thousands of actual and potential product applications. Talk with the men who engineered these products. Get technical information and literature to help you solve design problems the year around. Find hundreds of ideas for doing a better job of designing new products and re-designing the old. 350 leading manufacturers will present their products to you on three floors of the new, giant New York Coliseum.
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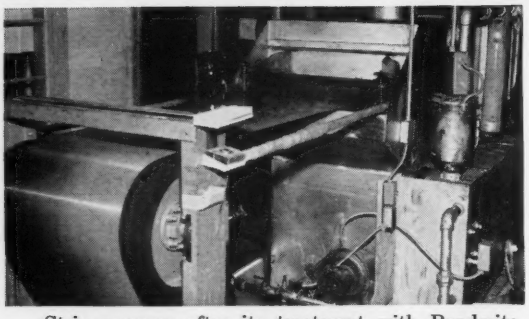
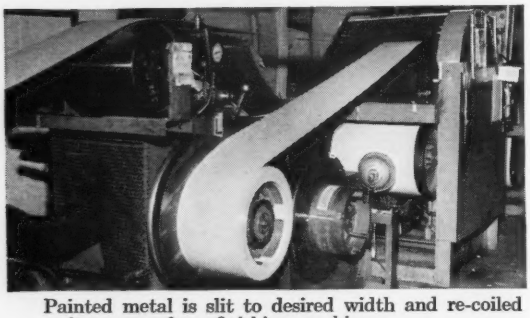
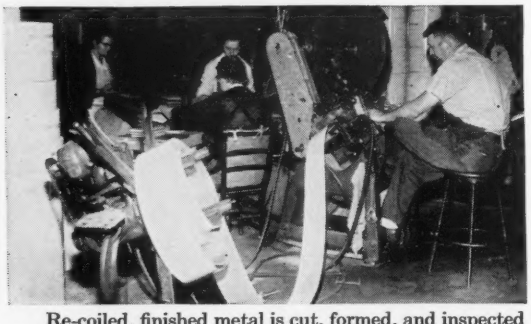


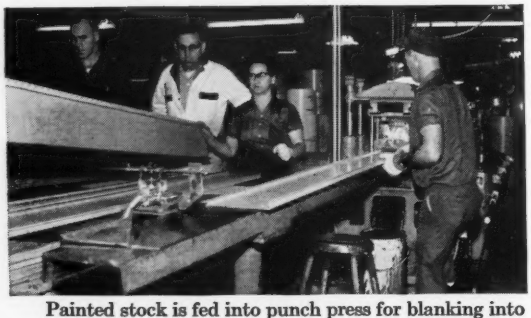
Strip emerges after its treatment with Bonderite, corrosion resistant paint bond.



Painted metal is slit to desired width and re-coiled as it emerges from finishing machine.



Re-coiled, finished metal is cut, formed, and inspected here. No loss of paint adhesion.



Painted stock is fed into punch press for blanking into various shapes and sizes.

Photos courtesy
Hastings Aluminum Products, Inc., Hastings, Michigan

Bonderized... Painted... Formed...

NO LOSS OF PAINT ADHESION!

Here's a production wrinkle that more and more manufacturers are using: Finish metal in the strip, then fabricate the product.

The technique applies equally well on steel and aluminum. First, run the strip through the Bonderite machine to produce the integral conversion coating that supplies a secure anchor for the paint. Next, run the Bonderized strip through roll-coat painting and the bake oven. The painted coils of metal are ready for fabrication, and the finish doesn't crack, chip or craze as it is formed, drilled, and punched.

Fabrication after painting, made possible by Bonderizing, saves money by reducing labor, handling and manufacturing area requirements, and allows higher production rates.

Write or call for more information on how you can finish before fabrication in your plant.

Bonderite, Bonderizing, Bonderized—Reg. U.S. Pat. Off.

PARKER RUST PROOF COMPANY
OF CANADA LTD.
Rexdale Blvd., Rexdale (Toronto) Ont.

Since 1914— leader in the field

BONDERITE	BONDERITE and BONDERLUBE	PARCO COMPOUND	PARCO LUBRITE	TROPICAL
corrosion resistant paint base	aids in cold forming of metals	rust resistant	wear resistant for friction surfaces	heavy duty maintenance paints since 1883

Gears

Spur Gears are available up to 17 feet diameter and 35 inch face. Large mill gears are a Hamilton Gear specialty.

Internal Gears, generated to 36 inch pitch diameter and formed-cut to 8 feet pitch diameter.

Bevel Gears can be made from any suitable gear material in sizes up to 62 inches diameter and any pitch.

Helical Gears, available in sizes up to 17 feet diameter, with any helix angle desired.

Herringbone Gears are produced in sizes up to 48 inch diameter with closed apex, and up to 17 feet with gap.

Worms and Wormgears. Hamilton Gear is equipped to hob wormgears up to 17 feet diameter. Worms available up to 14½ inch diameter.

Racks of Standard Pitch are produced in normal lengths up to 25 feet, special lengths up to 45 feet.

Helical Gear Reducers are made in single, double and triple reductions; and in ratios up to 833 to 1 and powers to 1500 H.P. Speed increasers are also available.

Wormgear Speed Reducers are available in single and double reductions; in ratios from 3⅝ to 1 to 6000 to 1.

Flexible Couplings can be supplied in pin-and-rubber buffers, and semi-universal Oldham types in all sizes.

Hamilton Gear's unique production facilities and superior craftsmanship are your guarantee of better quality and faster delivery on any industrial gear order.

Hamilton Gear and Machine Co., Limited.

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Spur Gears *Helical Gears* *Herringbone Gears* *Bevel Gears*

In all sizes for every industrial application— *Wormgears* *Spiral Gears* *Speed Reducers* HGC-155

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means production savings

The right grain size can often mean the difference between a poor finish produced at high cost and a gleaming, lustrous finish made at substantial savings. This is one of the *High Inner Qualities* you can count on in Noranda sheet and strip brass. Noranda offers a *range of grain sizes*... can help you select the *right* one, combined with other *inner qualities*, to boost production and lower costs.

Our nearest sales office will be glad to show you how to profit with Noranda sheet and strip. Let us put Noranda *High I.Q.* to work for you today.

This folder on grain size, "The 4th Dimension," will be sent to you on request.

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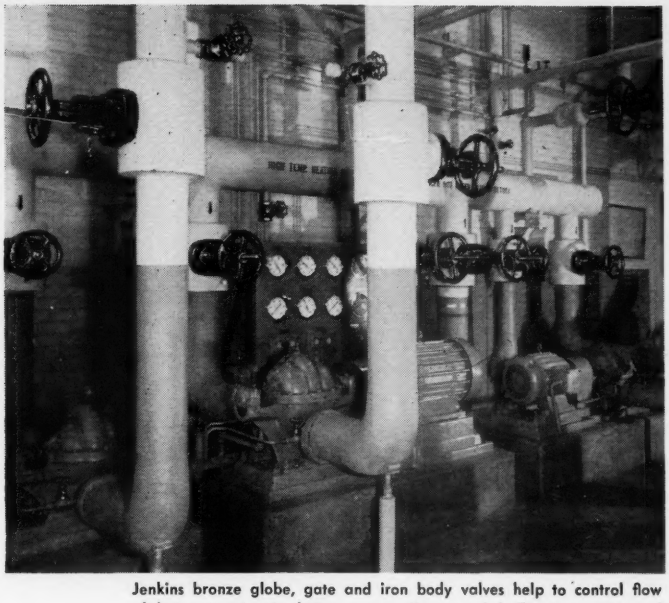
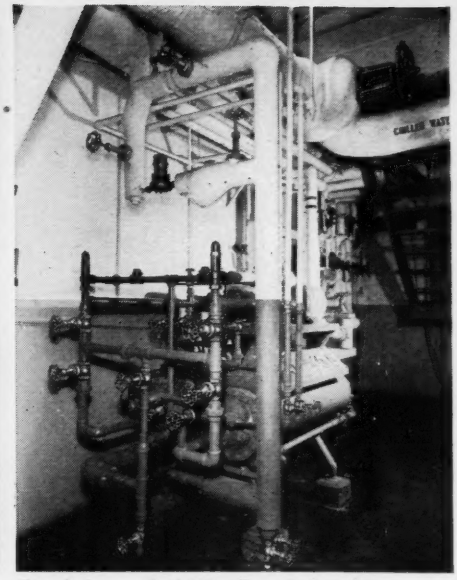


Jenkins bronze globe, gate and iron body valves help to control flow of hot water in circulating pumps. Year-round boiler temperature of 200 degrees must be maintained because of delicate film processing.



These fuel pumps feed 125 gallons of oil per hour to massive fire-tube boilers. Jenkins globe, gate and swing check valves regulate the flow of the oil.

Playing an important back-stage role
for the National Film Board...
versatile **JENKINS VALVES**

Architects:
Ross, Patterson, Townsend & Fish, Montreal
Consulting Architects:
John & Drew Eberson, New York
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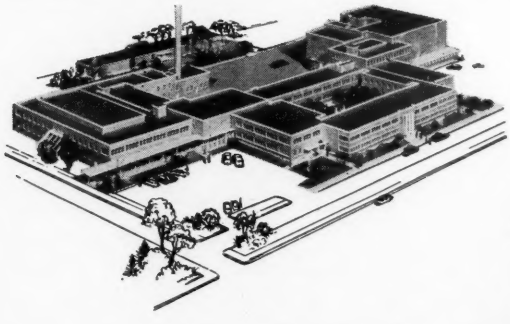

Equipment for the National Film Board's new $6,000,000 home in St. Laurent, Quebec, had to meet the exacting performance standards set by the building engineers. Among the 1,800 controls required to serve the Film Board buildings are dependable Jenkins valves, famous for high efficiency and low maintenance cost. When specifying valves, remember: *It pays to deal with specialists* — like Jenkins.

Making Valves Is Our Business — Our Only Business

The Jenkins "Diamond" trade mark is your assurance of complete satisfaction.
Sold through leading industrial distributors

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LOOK FOR THE DIAMOND MARK
VALVES
TRADE JENKINS MARK

Jenkins Bros

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Acme Screw Products Have Solved Many Specialized Problems . . . They Can Solve Yours!

Specialization always results in greater efficiency at less cost, plus the development of greater skill. That's a good thought to keep in mind the next time you are faced with a problem requiring the production of a special part. We ask that you remember us at that time as specialists in Screw Machine Products.

We ask that you consider our line-up of automatic screw machines at your immediate disposal — our Brown & Sharpe and Gridley Automatics — plus a staff of experienced operators skilled in the use of these machines.

We ask that you consider our Engineering Department, wise in the ways of fabricating steel, brass or aluminum — experienced through two wars and more than a quarter century of industrial expansion.

And finally, we invite you to send along your blueprints so that we can join our experience with yours in helping you to find a better way — a more economical way — and quite often an easier way to produce your goods.

CANADIAN ACME SCREW & GEAR, LIMITED

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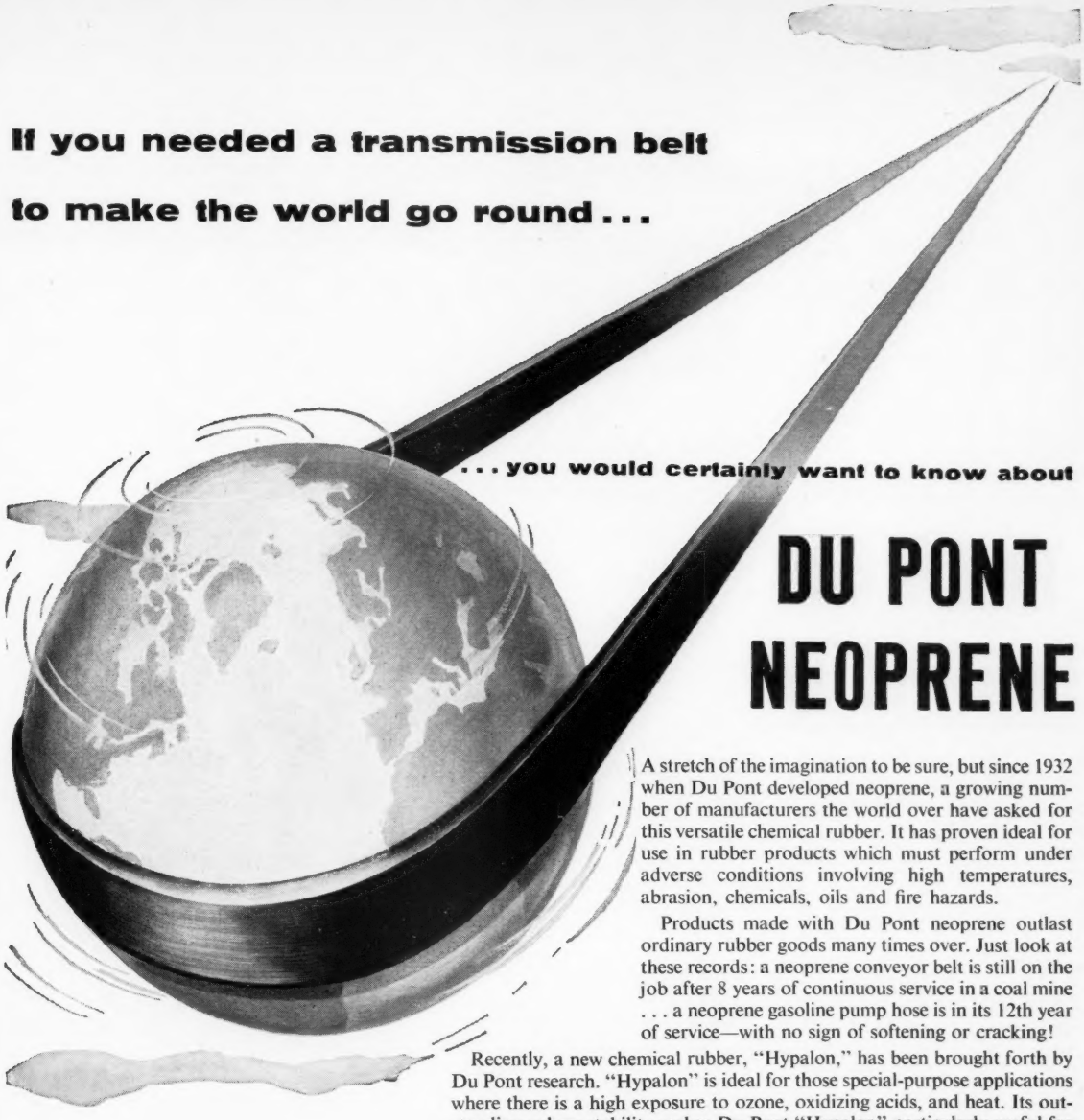
If you needed a transmission belt

to make the world go round...



...you would certainly want to know about

DU PONT NEOPRENE

A stretch of the imagination to be sure, but since 1932 when Du Pont developed neoprene, a growing number of manufacturers the world over have asked for this versatile chemical rubber. It has proven ideal for use in rubber products which must perform under adverse conditions involving high temperatures, abrasion, chemicals, oils and fire hazards.

Products made with Du Pont neoprene outlast ordinary rubber goods many times over. Just look at these records: a neoprene conveyor belt is still on the job after 8 years of continuous service in a coal mine . . . a neoprene gasoline pump hose is in its 12th year of service—with no sign of softening or cracking!

Recently, a new chemical rubber, "Hypalon," has been brought forth by Du Pont research. "Hypalon" is ideal for those special-purpose applications where there is a high exposure to ozone, oxidizing acids, and heat. Its outstanding colour stability makes Du Pont "Hypalon" particularly useful for coloured rubber products that must age well under weathering.

Du Pont makes raw neoprene and "Hypalon" for sale to rubber manufacturers. These chemical rubbers are used by industry in a great variety of mechanical goods—conveyor belts, hose, cables—and other items. Du Pont neoprene and "Hypalon" also find their way into the component parts of consumer and durable goods of high quality.

FOR FURTHER INFORMATION *about locally manufactured products made of these two chemical rubbers write:*

Du Pont Company of Canada (1956) Limited,
Chemicals Department, Room A-4, P.O. Box 660, Montreal, Que. DE-4

If you mail us this coupon, we'll put you on the mailing list for free illustrated publications full of interesting articles about neoprene, "Hypalon," and their applications.

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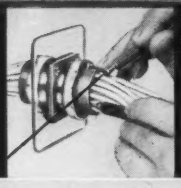
new

a single or multiple disconnect using seamless, crimp-type terminations

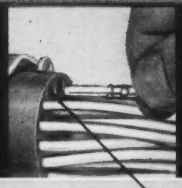
UNILOK — HALF THE SIZE AND WEIGHT OF COMPARABLE *AN* CONNECTORS

In one compact unit, conforming to standard AN connector mounting dimensions, UNILOK offers the advantages of a gang connector, or a separable connector for each circuit. Small terminals allow completed harness to be pulled through openings no larger than the cable bundle itself. Circuit checks are simple in either fully or partially assembled UNILOKS.

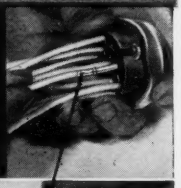
Easy Circuit Check
Probes reach insulation grip of socket terminating each wire. Printed numbers on all faces of plug and receptacle make circuit identification simple.

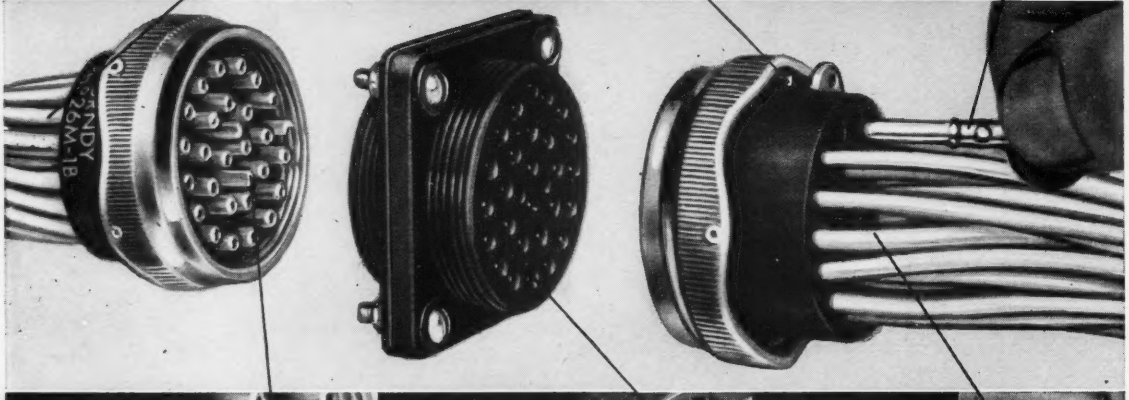


Quick Multiple or Individual Connections
Any wire is easily inserted or removed from plug individually. Each contact clearly identified on all six faces of plugs and receptacle.

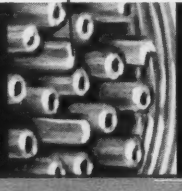


Crimped Terminations
Each connector is crimped on the insulation as well as on the wire. Provides maximum mechanical and electrical efficiency. Eliminates need for cable grip.

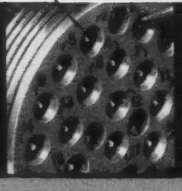




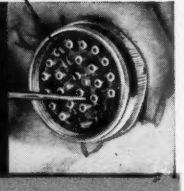
Rapid, Foolproof Assembly
Tough nylon polarizing pins engage corresponding holes before threads or contacts can engage.



Short Circuit Prevention
Recessed pins eliminate possibility of shorts from accidental contact of plug and receptacle.



High Pullout Resistance
Pull-out from plug (in excess of 50 pounds) is maintained by compression spring locks. Lock is quickly freed for wire removal by small screwdriver or knife blade.



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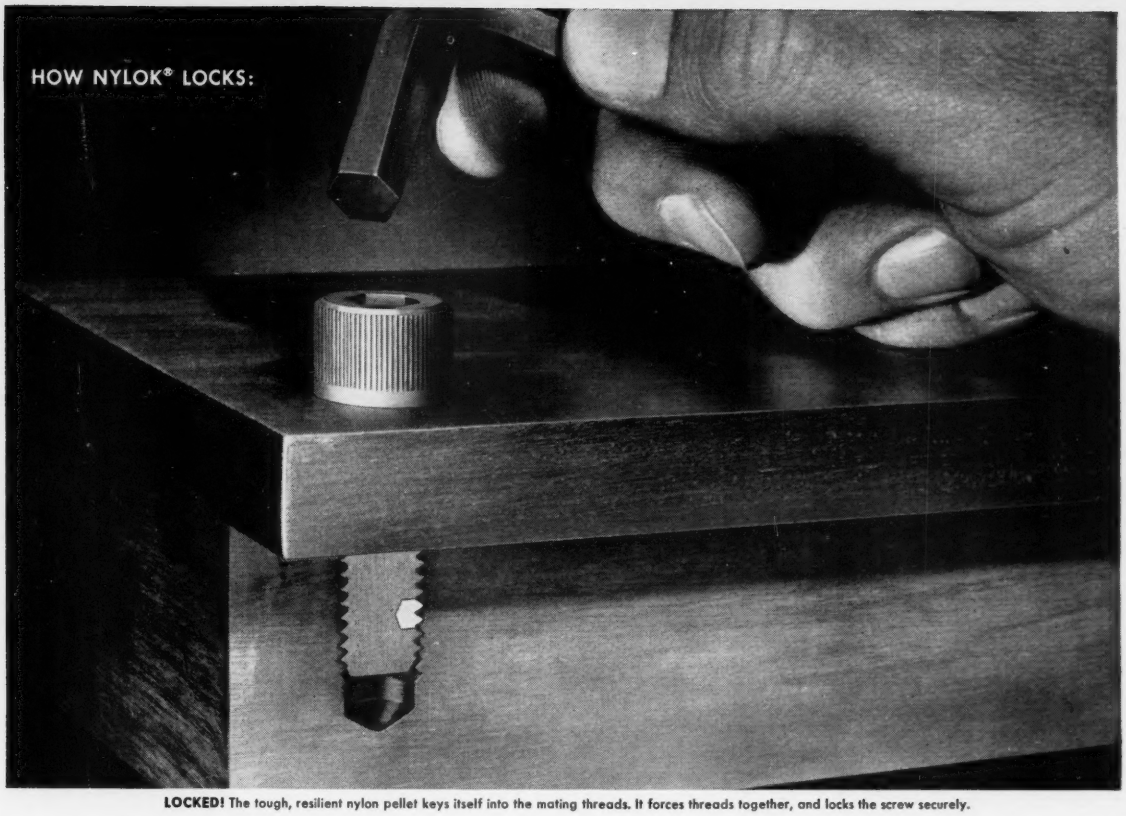

LOCKED! The tough, resilient nylon pellet keys itself into the mating threads. It forces threads together, and locks the screw securely.

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UNBRAKO socket screws are now available embodying the Nylok* self-locking principle. Nylok provides a truly practical new solution to the problem of making screws self-locking.

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Self-Locking UNBRAKOS are completely reusable. They have uniform locking and installation torques—with no galling or seizing on mating threads. They successfully withstand temperatures from —70° to 250°F. And, on properly seated screws, the pellet acts as a liquid seal.

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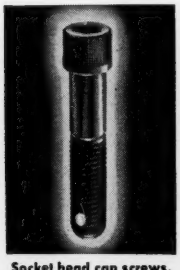
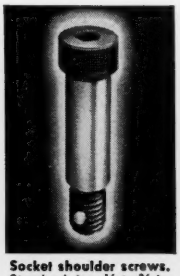
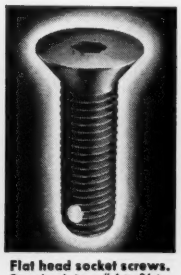


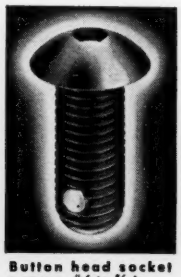
Socket head cap screws. Standard sizes #6 to 1 in.



Socket shoulder screws. Standard sizes ¼ to ¾ in.



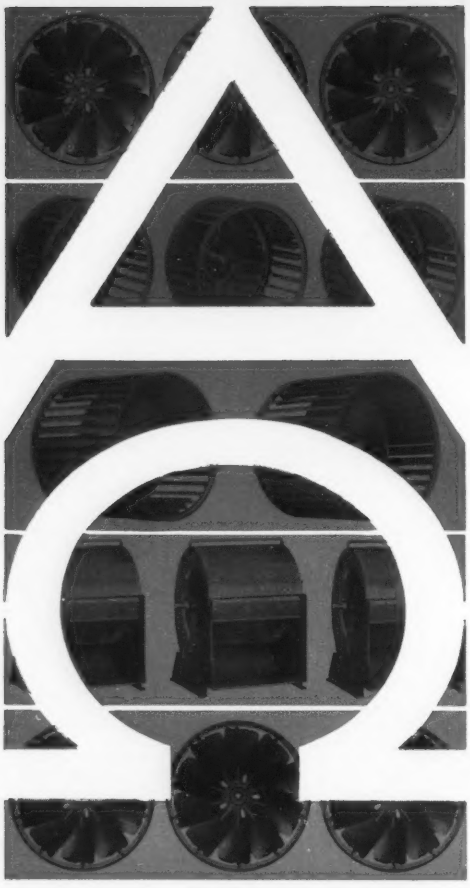
Flat head socket screws. Standard sizes #6 to ¾ in.

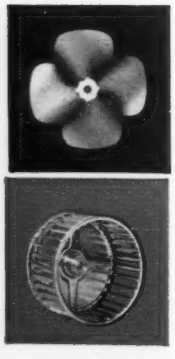


Button head socket screws. #6 to ⅝ in.

Socket pressure plugs. Standard sizes ⅛ to 1¼ in.

Socket set screws. All standard point types. #6 to 1 in.





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People

Important people who are in the news

Military consultant

Group Captain C. B. Limbrick, CD, AFCAI, has been appointed military consultant to the Canadian Westinghouse Company's electronics division. A former special weapons and communications expert at RCAF headquarters, Ottawa, G/C Limbrick will serve as consultant on technical requirements for military electronic equipment. He will also assist in long-range Westinghouse planning for military development projects.

Born in England, G/C Limbrick had a colorful career in the armed forces on land, sea and air. He served in the British, Canadian and French armies, Royal Navy, Royal Marines, RCAF and was attached for some time to the RAF. He was twice wounded and gassed in World War I.

Resident turbine engineer

The Amalgamated Electric Corp. Ltd., in conjunction with the heavy engineering division, the General Electric Co. Ltd. of England have announced the appointment of **Mr. Ronald H. Meadows** as resident turbine engineer in Canada. Before coming to Canada Mr. Meadows was the senior turbine sales and contracts engineer for the heavy engineering division of the General Electric Co. Ltd. of England.

While Mr. Meadows will mainly be concerned with large steam turbines and motor-driven compressor plants, he will be available to further enquiries in connection with the development of atomic energy proposals.

Honorary Fellow

Air Commodore F. R. Banks, CB, OBE, MIMechE, FRAeS, a director of the Bristol Aeroplane Co. of Canada (1956) Ltd., has been named as a 1956 Honorary Fellow of the American Institute of the Aeronautical Sciences, in recognition of his outstanding contributions to aviation.

This honor is the highest that the Institute can bestow. Honorary Fellows are people of eminence in the field of aeronautics, and two are elected each year by the IAeS, one American and one foreign Honorary Fellow.

Hogg appointed sales manager

William J. Hogg has been appointed sales manager in charge of rubber chemicals and plastics at Naugatuck Chemicals.

He joined Naugatuck in 1947 and has held various positions in the production and sales departments of the division. His new assignment will cover sales activities in the growing markets for rubber chemicals and plastics.

Hogg is a graduate in chemical engineering from the University of Toronto.

Laver and Pettersen appointed

W. R. Watkins Co. Ltd. have announced the appointment of Messrs. **A. Laver** and **T. Pettersen** to their technical staff. Mr. Laver gained practical experience in aircraft engineering after graduation as flight engineer on the London-South Africa route and test flying the Vickers Vicount. He has 11 years' experience on many different aircraft and 3 years in various phases of engineering.

Mr. Pettersen graduated from the University of Toronto with a B.A.Sc. and followed this with 4 years as production engineer for Dowty Equipment Ltd. Recently Mr. Pettersen was a technical representative with Rogers Majestic Electronics Ltd. He is a member of the Association of Professional Engineers of Ontario.

Both men bring years of valuable technical experience to the company.

Honeywell names four

Four appointments within the industrial division, eastern region, Honeywell Controls Ltd., have been announced. Involved in the changes are **R. J. Wood,** who becomes sales supervisor, power industry; **W. K. McMenamon,** who becomes sales supervisor, pulp and paper industry; **R. M. Everett** recently named as application engineer; and **Owen N. Smith** who was appointed sales supervisor, Montreal branch, industrial division.

English Electric appointment

Appointed gas turbine sales engineer in western Canada by the English Electric Co. of Canada Ltd. is **J. B. Bowron.** A Calgarian by birth, Bowron obtained his B.Sc. in electrical engineering from the University of Alberta. He has just recently returned from the U. K. where he was in English Electric's gas turbine department at Whetstone. Experience in England included the erection, testing and sales of gas turbines.

Atlas Titanium's new manager

Mr. T. Howard Adair has been appointed manager of Atlas Titanium. He replaces Mr. D. H. Munro who has given up his managerial duties to accept the position of assistant comptroller of Atlas Steels Ltd., parent company of Atlas Titanium. Adair was named technical director of Atlas Titanium when the company was formed over a year ago.

INCO appointment

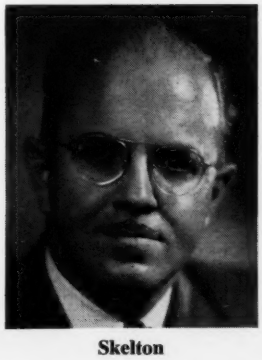
Herbert A. Skelton, B.A.Sc., P.Eng., has been appointed to the staff of the Canadian development and research division of the International Nickel Co. of Canada Ltd. He will be directly concerned with the mechanical and metallurgical problems in welding, fabrication and general manufacturing fields.

Born in Weston, Mr. Skelton received his B.A.Sc. degree in metallurgical engineering from the University of Toronto in 1940. He is a member and has served on several government specification board committees, such as the committee on specifications for non-destructive testing and the ferrous casting committee.

Adair

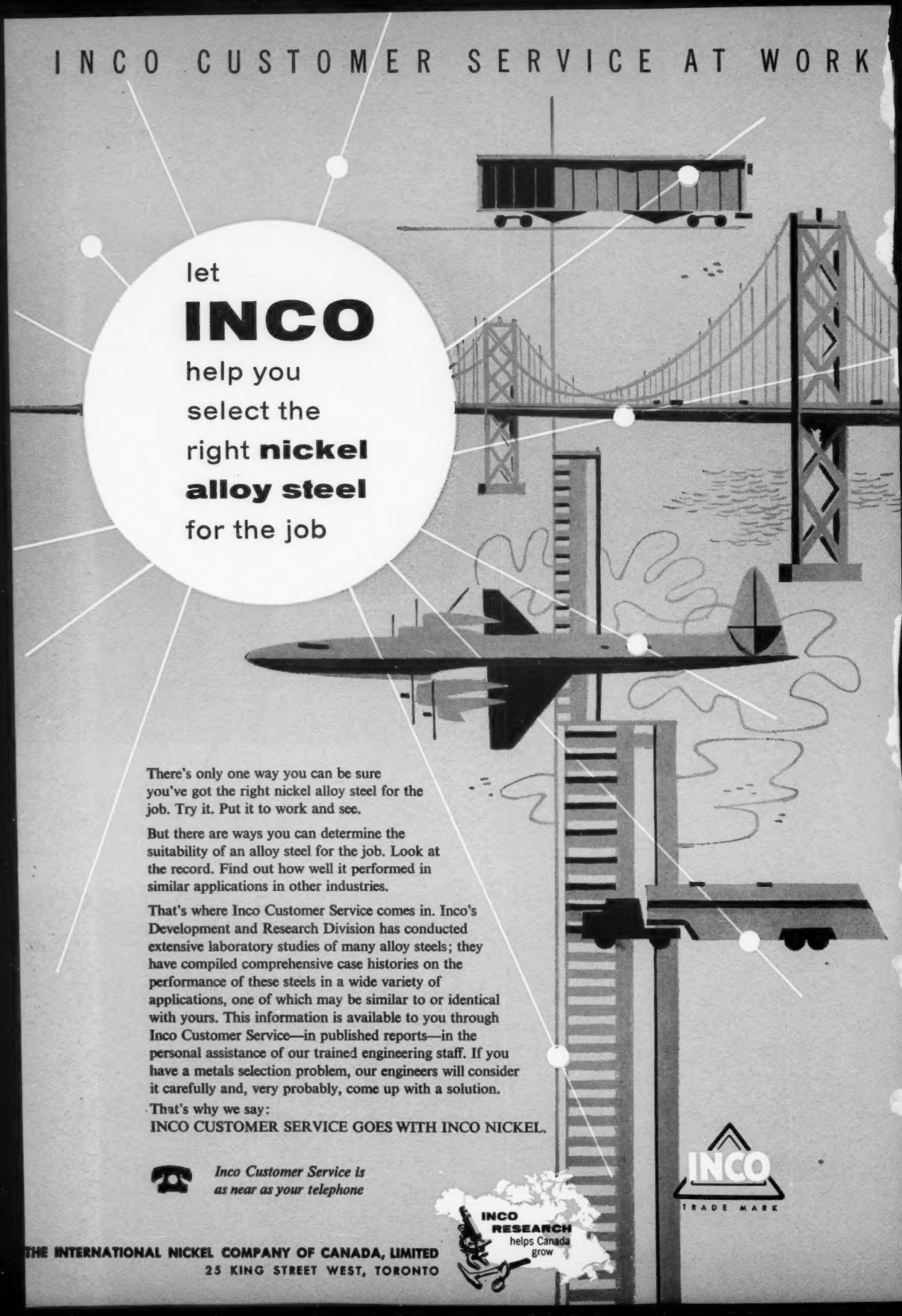
Laver

Pettersen



Skelton

INCO CUSTOMER SERVICE AT WORK



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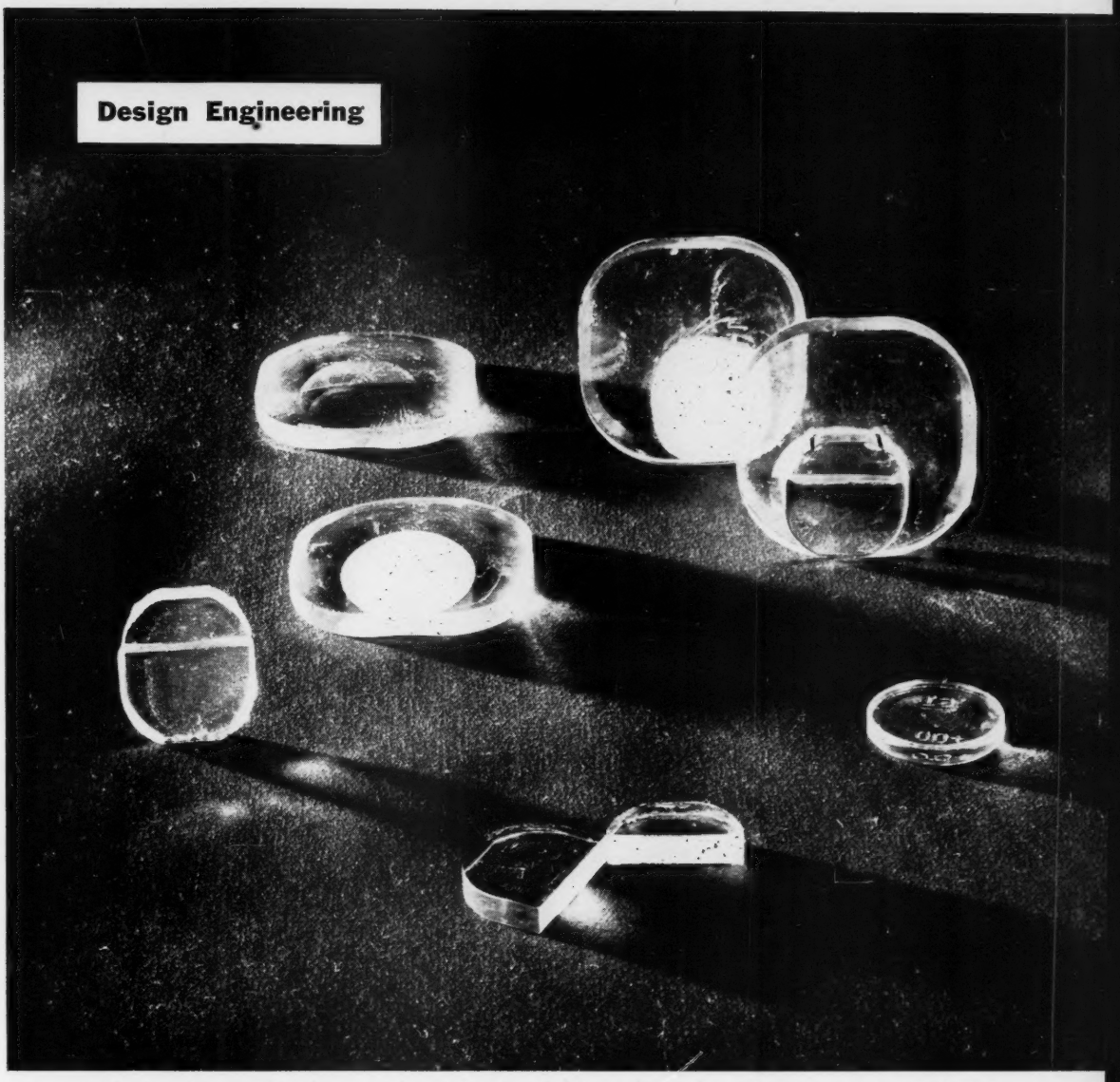


A far cry from earlier days are these trifocal and bifocal lenses in various stages of manufacture.

How do they make eyesaving spectacles?

By Fred W. White IMPERIAL OPTICAL CO.

The invention of the printing press by Gutenberg in the 15th century intensified the desire of many people to see fine detail and to read and take advantage of the writings that were available.

The earliest lenses on record were the simplest type of magnifying or burning lenses made from quartz, emerald and other similar transparent substances. With the discovery of glass (with its wonderful transparent qualities), lenses were gradually designed to be used as visual aids (first

Credit for the invention of the first bifocal lens must go to Benjamin Franklin

The finished product. Although impossible to tell here, the lenses in this pair of spectacles are bifocals.

Multifocal lenses continued

as a simple magnifier and subsequently as a reading lens) so that a person of advancing age could see the fine detail in such work as weaving. His productive life was thereby prolonged far beyond what had previously been possible.

Later, the spectacle frame was developed and reading lenses placed before both eyes, thus giving the wearer binocular vision and providing a greater field of vision, as well as restoring depth perception.

About the 17th century the use of lenses for everyday distance vision was introduced as conditions of the eye, called hyperopia (far-sightedness, Figs. 1(b) and (c)) and myopia (near-sightedness, Figs. 1(d) and (e)) were discovered and corrective measures investigated and developed. Still later, astigmatism (or varying curvature in different meridians of the eye, Figs. 1(f) and (g)) led to the production of cylindrical surfaces on lenses instead of the purely spherical surfaces (Fig. 2) previously considered sufficient.

The production of the long radius, spherical curves that characterize the earlier lenses (Fig. 2) required only that the glass be lapped on a metal or stone tool of the desired curvature. This could be done on a crude type of rotating spindle (such as a potter's wheel) or could, of course, be done more laboriously by rubbing the glass on the tool or lap by hand, using an abrasive like corundum or any hard sand. Successively finer grits were used and the final polish produced by rubbing the surface with a cloth or felt to which a polishing agent (like oxide of iron) is first applied. Later lens developments required curves of smaller radii. The grinding of these steeper curves does not involve too great a problem in the light of our present-day knowledge, although at the time they represented quite an achievement. Doubtless those responsible for the designing of the necessary machinery were quite proud of their success.

Lenses for the correction of hyperopia require convex curvatures, while those for myopia required concave curvatures (Fig. 1). Later investigation showed that the over-all curvature or bending of the lens has an important bearing on the field of view in which clear vision may be expected. As a result, modern lenses are bent to a concave-convex form, with the concave surface of longer radius than the convex for hyperopic correction, and the reverse for myopic correction.

The introduction of cylindrical surfaces (Fig. 1 (g)) for the correction of astigmatism posed a much greater problem, for machines had to be devised that would permit a rubbing, abrasive action to take place between the lens and lap and, at the same time, keep both lens and lap lined up with each other. Even half a degree rotation with respect to one other could not be tolerated. A reciprocal action is required which follows a varying path that will not repeat until many oscillations have occurred.

Benjamin Franklin was apparently the first to consider the possibility of combining the lenses he required for distance vision with those he needed for reading. He thus became the inventor of the bifocal, which has now been developed and perfected to a degree far beyond even his imagination. This has been to a great degree due to the ingenuity and inventiveness of design

The introduction of bifocals also introduced added design problems in the production of

How we see

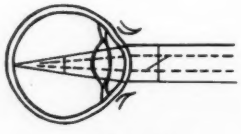


Figure 1a. *The normal eye.*

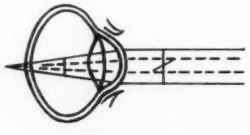


Figure 1b. *Far-sightedness.*

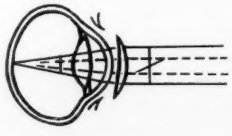


Figure 1c. *Fault corrected.*

engineers who have developed intricate processes to permit the combining of glasses of differing properties by fusing, so that two or more areas of varying powers may now be obtained in a single lens. This result is also achieved by the elaborate grinding of a single piece of glass to produce the varying powers, by means of a variation in curvature of the lens surface.

With the introduction of bifocals, the design problems were greatly complicated. Greater strides in the development of optical machinery have taken place over the past two or three decades than were made during the entire previous history of lens development. Instead of producing curvatures by a lapping process, the required curves are now generated by means of machines having spindles which may be angled to any degree required. Two such spindles with their operating heads placed face to face are mounted by appropriate means, so that the lens may be placed in (or attached to) one spindle head, and a suitable grinding tool attached to the other. The spindles can then be adjusted so that the grinding tool contacts the glass at the required angle to produce the desired curvature.

The curve so produced is not dependent in any way on the curvature of the grinding tool but is a result only of the angle at which the grinding tool has been presented to the glass surface. Generally, the spindle on which the lens is placed or fastened is held in a single position whilst the other spindle is angled to the required degree.

The process of generating curvatures (instead of lapping them) is admirably suited to the use of diamond impregnated tools. This ensures absolute accuracy of setting and constant maintenance of an accurate setting. This is because the diamond impregnated tool wears away so slowly that the compensation for wear must be made only at very infrequent intervals. The Imperial Optical Company pioneered in the development and use of diamond impregnated tools, which are now utilized in the manufacture of all their Corectal single vision and bifocal lenses.

It is by an application of the generating principle (combined with diamond impregnated grinding tools) that it is possible to produce a lens surface having areas with differing radii of curvature. The diamond impregnated grinding tool is annular in form (Fig. 3) permitting the spanning of a central area so the curvature being ground covers only the outer part of the surface, leaving a circular area in the centre of the surface untouched. With a much smaller diamond tool (and a change in the angle of the grinding head) the central area can later be ground to a curve having a different radius. In actual practice, in order to ensure absolute concentricity, both these grindings are carried out without removing the lens from the machine. By this means it is also possible to have the two areas merge one with the other without any break, so that the outer margin of the central area coincides exactly with the inner margin of the outer area. A blank of this type is later cut and finished in such a way that this small central area is placed in the appropriate position on the finished spectacle lens. Usually this area is on the concave surface and is of larger radius than the bulk of the surface, in order to produce a plus

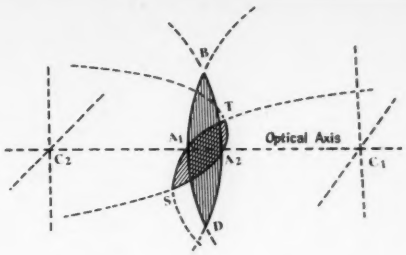


Figure 2.

Spherical surfaces of the earlier lenses.

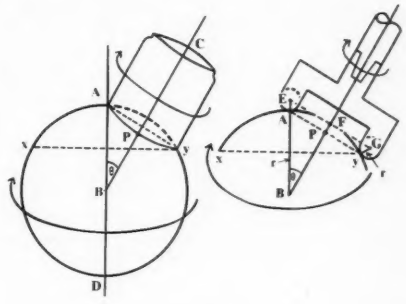


Figure 3.

Modern diamond-impregnated grinding tool.

the lenses. Fast-developing optical machinery has so far managed to solve the problems

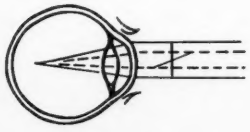


Figure 1d.

Near-sightedness.

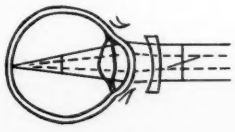


Figure 1e.

Fault corrected.

Figure 1f.

Varying curvature.

Figure 1g.

Fault corrected.

(or magnifying) effect of the desired power for reading. The location of this area in the finished spectacle lens is therefore usually in the lower part which is, of course, where the eyes are usually directed for reading. This one piece type of bifocal is known by Imperial as the Ultex.

Polishing of lens surfaces is done on wax or pitch impregnated felt, using a number of different materials as the polishing agent. The rouge or iron oxide used for many years has been replaced to a great extent by the use of tin oxide, zirconium oxide and cerium oxide, the last named being by far the most efficient.

Bifocals are produced also by combining glasses of varying qualities. The three commonly used glasses in the production of spectacles (whether single vision, bifocals or trifocals) are: crown glass, which is used for most single vision lenses and the main lens in bifocals and trifocals; flint glass, which has a high lead content and a greater refractive power; and barium glass which, as its name implies, has a high barium content. The last two are used mainly to produce the increased positive power or added effect in bifocals or trifocals, since their higher refractive power produces a greater magnifying effect.

The power of a lens is dependent on the curvature of its surfaces combined with the density or refractive quality of the glass. The refractive quality of the glass is commonly referred to as its index of refraction. The higher the index of refraction, the greater the power (or the shorter the focal length) of the lens (See Fig. 4) that will be produced by identical curvatures of the surface.

The focal length is, of course, the reciprocal of the power. Spectacle lenses are generally described by their power, using a unit of measure called the dioptre. Other types of lens (such as are used in instruments and binoculars) are generally described by their focal length.

It will be readily understood from the foregoing that, by a judicious selection of glass and grinding (to get the appropriate curves), two or more glasses may be fused together so that part of the lens area will have a greater positive power than the remainder. To accomplish this, a depression, having an accurately calculated curvature, is ground into the lens surface of the major crown glass that is used for the main blank. Into this depression is fused a flint or barium segment, having identical but opposite curvature. The entire surface of the assembly is then leveled by grinding to the extent necessary to reduce the size of the depression (in which the flint or barium glass has been fused) to the desired diameter, usually 22 mm. The traditional Kryptok bifocal (Fig. 5) with a circular reading segment, is made of a crown blank and flint bifocal segment.

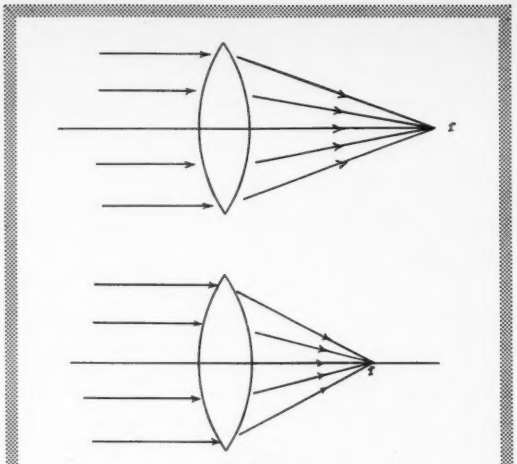


Figure 4.

While both lenses have the same curvature, the lower one has a higher index of refraction and therefore brings the rays from a parallel beam of light to a focus (f) closer to the lens, i.e. it has greater power.

A further refinement is achieved when the flint or barium segment is first cut into two pieces and each piece edge-fused (to a similar piece of crown glass) to form a complete segment, half of which is of crown glass and the other half of either flint or barium. The piece of crown glass in the segment is, of course, identical with the glass used in the main lens blank. The combination segment is then fused into the depression mentioned previously. After the leveling process, the crown part of the segment merges with the main lens to become invisible, leaving a segment of higher plus power, semi-circular in shape. The advantage of this type of bifocal is that the eye may now enter the higher powered section at its centre instead of at the margin.

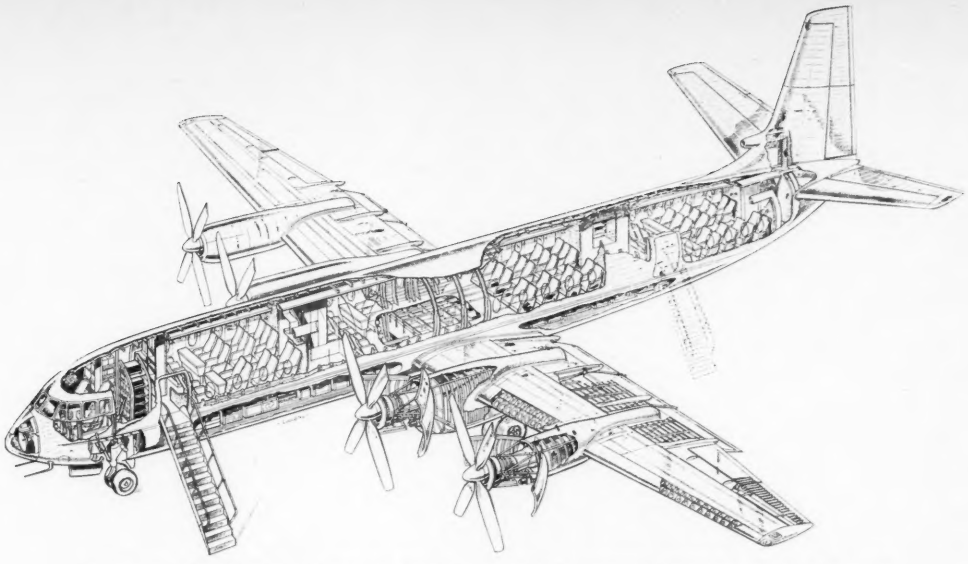
This eliminates a defect common to circular segments, called "jump of image," which actually is an apparent sudden displacement of objects as the eye enters the reading segment. An example of this type of manufacture is the Monostep "flat-top" bifocal (Fig. 5), possibly the most popular and efficient type available today.

The foregoing technique is used also in the production of trifocals by using two or more pieces of barium or flint glass of varying indices of refraction. The variation of power in the various areas is limited only by the variation of refractive index available.

The problem of producing a lens is largely that of designing machinery that will give the curvatures required to the extreme accuracy that is so essential, together with control of depth of cut (or diameter of opening) frequently to the order of 0.0001 in. ★

Three of the multifocal lenses now available

Fig. 5. Left bifocal is better because eye enters lower segment at its centre rather than its edge.



Layout of the 93-seat airliner is clearly seen in this exposed drawing of the Vanguard.

New airliner to fly the Canadian skies in 1960

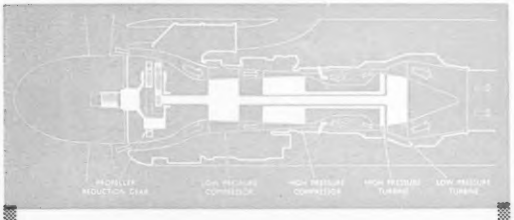
Delivery of the Vickers Vanguard to TCA will begin early in the fall of 1960.

A comprehensive survey has shown that an aircraft with a range of 2,500 miles could operate 86% of the world's international airline routes. The Vanguard was consequently developed to carry full payload over this distance. It is designed for high speed operation on medium and long-range routes.

The aircraft is powered by four Rolls-Royce Tyne RB109 propeller-turbines. Cruising speed is 400 mph.

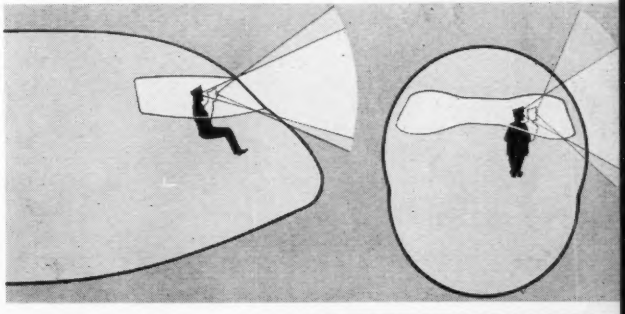
The Vanguard is a mid-wing monoplane with a pressurized double-bubble fuselage, the upper section providing accommodation for passengers and crew, the lower portion being devoted to freight. Two very large freight holds are, in fact, provided under the cabin floor so that freight may be carried without the expense and delay of conversion.

The standard 93-seat layout is arranged to carry passengers in a new concept of comfort, with plenty of space, good lighting and all comforts at hand or on call.



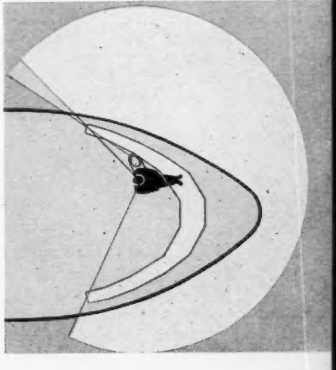
What about the engine?

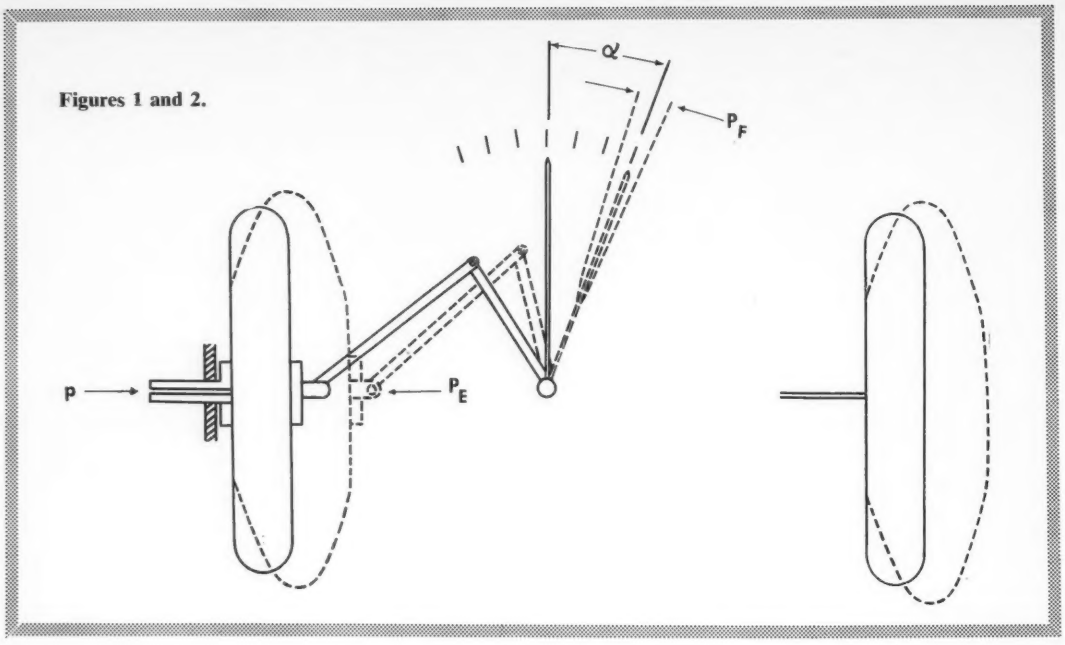
The Tyne RB109 is a two-shaft, high-compression ratio propeller-turbine developing initially 4,020 shp plus 1175 lb of jet thrust for take-off. The arrangement of the engine is such that the high-pressure compressor is driven by its own turbine. The low-pressure compressor (and the four-bladed propeller) are driven by a separate turbine, the shaft of which runs inside the high-pressure shaft. The propeller is coupled to the low- pressure shaft through a compound epicyclic reduction gear, the internal mounting of which has been carefully designed to damp out vibration and thus improve engine reliability and passenger comfort. These aspects have also been taken into consideration in the design of the engine mounting.



Fields of view

Visibility from the pilot's seat in the Vickers Vanguard is exceptionally good for a 'plane of this size. Horizontal field of view is 250° and can be increased slightly by leaning to port. The end view (top right) shows the "double bubble" of the fuselage quite plainly.





Figures 1 and 2.

Can pressure be measured accurately?

Extreme accuracy in pressure measurement is hard to achieve. How are errors reduced?

By U. Cunard SPERRY GYROSCOPE CO. OF CANADA

A very old principle is still in use today for stationary barometers and manometers. The unknown pressure displaces a column of mercury, water or kerosene in a glass tube. The vertical displacement (together with the known density of the liquid) is a measure of the pressure. This principle cannot be used easily in the construction of portable or industrial instruments and its application is therefore limited to laboratory or calibration purposes.

Almost all other pressure measuring (or controlling) devices have a number of features in common. The unknown pressure is usually applied to a chamber or capsule, which alters its volume until the forces caused by pressure balance against elastic forces. The measurement is obtained as the linear (or angular) displacement of a point on the surface of the chamber. These are instruments using diaphragm capsules or Bourdon tubes as sensors.

Fig. 1 shows the arrangement of such an instrument with a diaphragm capsule as the pressure sensing element. Subjected to an internal overpressure p, the volume of the capsule will increase (as shown by the dotted lines) so that the pointer will deflect an angle α. We assume that the capsule deforms elastically, but that a certain amount of friction occurs in the mechanism. For every value of the pressure p, balance must exist between the forces acting, in accordance with the equation:

$$pa = P_E \pm P_F \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

"a" is the area of the capsule, P_E the elastic and P_F the friction force. This area "a" is by no means constant, as the diameter of the capsule depends upon the pressure p. That is,

$$a = f(p) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

P_E represents the elastic force, opposing expansion of the capsule. It will be linked to the deflection angle of the pointer by some kind of relation and can be expressed therefore as a function of this angle.

$$P_E = g(\alpha) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Equations (1) to (3) can be combined to give:

$$pf(p) = g(\alpha) \pm P_F \quad \ldots\ldots\ldots\ldots\ldots (4)$$

It can be seen immediately that, for every finite value of p, this equation can be satisfied by at least two values

Note from the author:

Many applications of pressure measurement have requirements for extreme accuracy and sensitivity, which cannot be met easily. The purpose of this article is to discuss the limitations of presently known instruments and to lay down basic design principles for instruments of higher accuracy.

The most troublesome sources of error in pressure measuring instruments are caused by friction and hysteresis. A servo instrument (operating on the force balance system) is discussed, where measuring elasticity and capsule elasticity are completely separated.

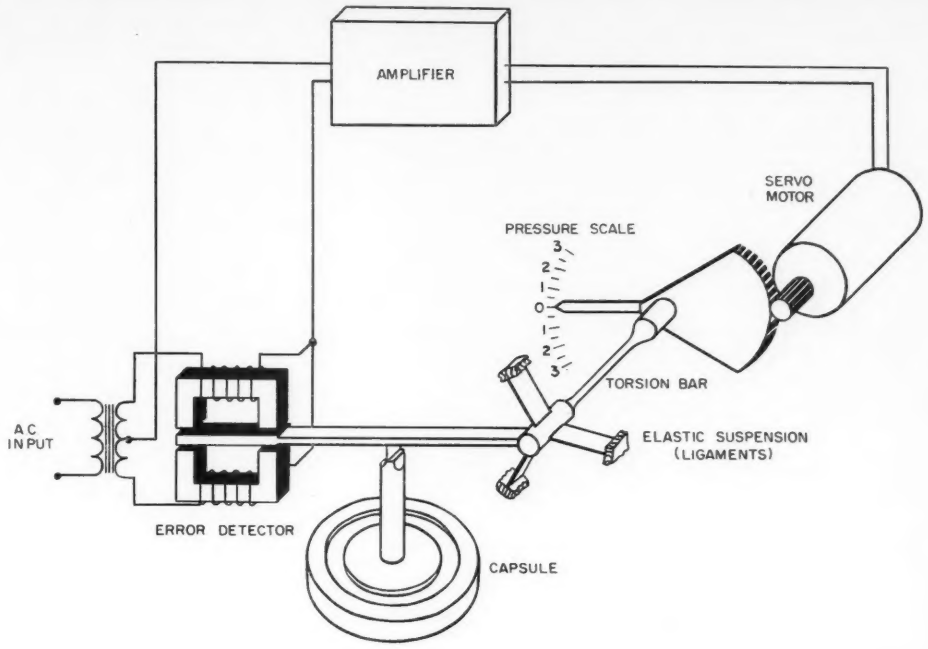


Fig. 3. The servo motor twists the torsion bar until the diaphragm resumes original position.

of pointer angle α, because of the existence of the friction force P_F with indefinite sign. The friction force will always oppose a change of deflection. It will be positive for decreasing pressures (and negative for increasing pressures) and will introduce uncertainty into the result. But it is not only friction that introduces uncertainties of measurement. The elastic forces, too, are indefinite to a certain degree, because of time effect and hysteresis.

Observation shows that a tensile load applied to an elastic member does not produce the final elongation immediately. There is always a certain amount of creep. That is, elongation continues slowly for a considerable length of time. This time effect depends on the material of the elastic member and upon the magnitude of stresses involved. It is much more pronounced for metals with a low melting point (like lead or tin) than for metals with a high melting point (like steel copper or nickel alloys). This time effect is usually attributed to sliding deformation within unfavorably orientated crystals after the load has been applied.

The influence of elastic after-effects and friction have been clearly understood by instrument designers for a long time. Reduction of friction has been achieved in two ways: by increasing the effective area of the capsules and by improvements in the instrument mechanism.

It can be seen from Equation 1 that an increase in the capsule area "a" causes an increase in the forces involved. If P_F (the mechanism friction) remains unaffected, a gain in accuracy is achieved. Furthermore, friction itself can be reduced by utilizing every possible advantage provided by designing and manufacturing skill to the transmission mechanism.

Proceeding further in this direction, instruments are available with electrical transmissions almost free from friction. On a typical design of this nature, a pressure-sensing diaphragm of ferromagnetic material controls the air-gap of two magnetic circuits and consequently influences the inductances, thus providing an electrical output. No mechanical friction is encountered in this type of magnetic transmission. Elastic after-effects and hysteresis, however, cause errors of approximately $\pm$ 0.5% of full range. This hysteresis value of $\pm$ 0.5% appears to be large in comparison with hysteresis figures for well-designed springs, made from special materials.

Diaphragm capsules are usually made in two halves,

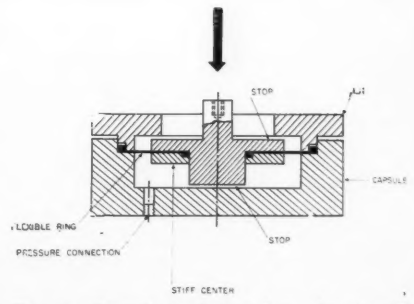


Fig. 4. Capsule is designed so that it will only flex at the narrow ring at the edge.

"It is apparent that the design elements necessary to eliminate hysteresis errors of the

connected together at the periphery. This connection has to be made by soldering, brazing or welding. Obviously, a process has to be selected so that the necessary heat treatment does not affect the elastic properties of the diaphragm material. This excludes brazing and welding for many of the best diaphragm materials, while soft soldering increases hysteresis, because of the bad elastic properties of tin-lead solder.

A diaphragm capsule, for instance, of 2 in. diameter made from phosphor bronze, joined with soft solder, can be produced to 0.15% hysteresis error. Use of beryllium copper (instead of phosphor bronze) improves the hysteresis figure to 0.1%. However, a coil spring made from best steel will show hysteresis figures much lower (between 0.08% to 0.02%) in accordance with the maximum occurring stress. Further reductions of hysteresis are possible by using special low hysteresis alloys, as for instance Ni-Span-C or Iso-Elastic. Both these nickel-steel alloys make excellent springs with almost negligible hysteresis error (0.01% or even less). A further advantage of these alloys is a modulus of elasticity almost independent of temperature. While the modulus of elasticity of steel varies by about 3% between —50 F and + 150 F, it hardly changes for Ni-Span-C over this range. The attractive elastic properties of these alloys depend upon careful cold working and heat treatment. It is much easier, therefore, to make springs or torsion bars from these materials than capsules, diaphragms or Bourdon tubes. This is the most important and obvious reason (though not the only one) for separating completely the capsule and the measuring elasticity.

Summarizing, we can say that errors are caused by friction and elastic hysteresis:

(1) Elastic after-effect and hysteresis errors can be vastly reduced by using special elastic alloys and by fully separating capsule elasticity and measuring elasticity.

(2) Friction errors can be greatly reduced by replacing the direct mechanical connection between capsule and indicator with an electro-mechanical transmission.

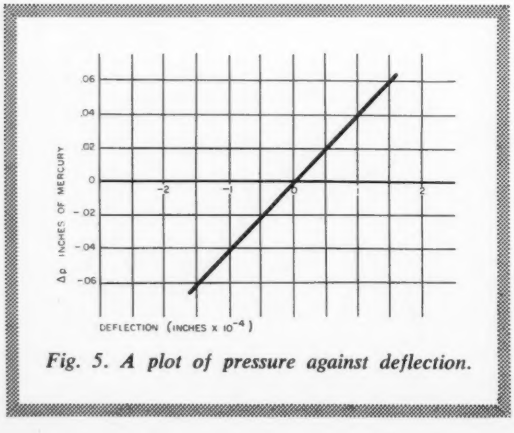


Fig. 5. A plot of pressure against deflection.

It will become apparent that design elements necessary to eliminate hysteresis errors of the measuring capsule will at the same time reduce friction errors.

Capsule Elasticity

Fig 2 shows a capsule (in full line) which deforms under the influence of an internal overpressure to a shape indicated by the dotted outline. If we assume constant temperature on expansion, the expression for the work done between the two pressure values P_1 and P_2 can be written as:

$$Q = J\left(\int_{P_1}^{P_2} V\,dp + \int_{V_1}^{V_2} p\,dv\right)$$

V_1 and V_2 are the capsule volumes corresponding to the pressures P_1 and P_2.

The expression $J\int_{P_1}^{P_2} V\,dp$ represents the work done to compress the liquid or gas contained in the capsule. This work can be recovered on subsequent expansion to the original pressure P_1.

The second integration $J\int_{V_1}^{V_2} p\,dv$ represents the work done in expanding the capsule from the original volume V_2 to V_2.

This work is stored as elastic energy in the metal of the expanded capsule and it is our aim to separate completely the capsule and measuring elasticity. This can be achieved by designing the capsule so stiff that only negligible elastic deformations occur on changes of pressure. The volume of the capsule will then be constant since the expression disappears for constant volume.

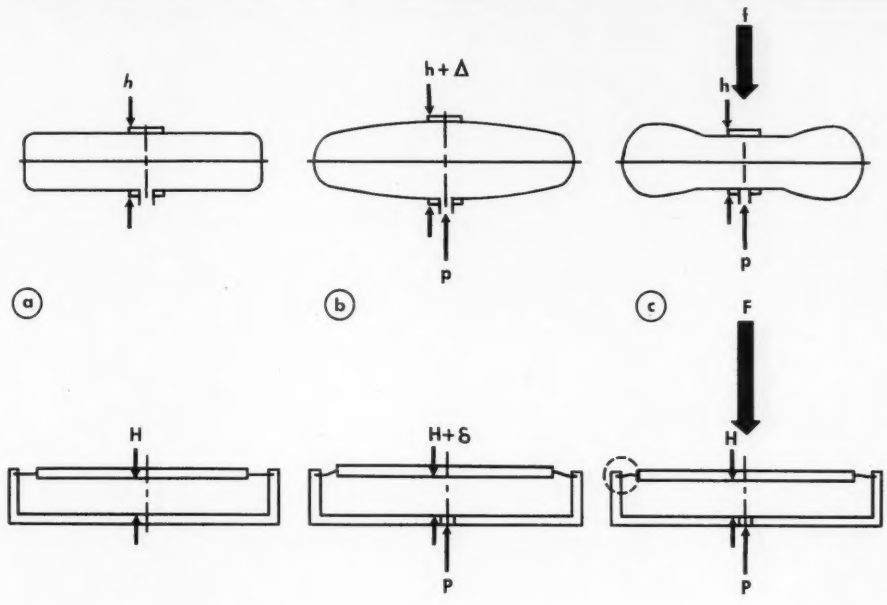
$$J\int_{V_1}^{V_2} p\,dv = 0 \text{ for } V_1 = V_2$$

Obviously, a completely stiff capsule cannot be used as a sensor for pressure changes. However, elimination of the capsule elasticity can be achieved either by restoring the capsule to its original volume (by means of a servo system) or by using a stiff piston in a cylinder whereupon no elastic deformations are possible.

The second possibility (a piston sliding inside a cylinder) has been used successfully for measuring purposes, when the required accuracy tolerates the unavoidable friction between piston and cylinder walls. This becomes a practical proposition when the pressures to be measured are high and the friction forces negligible therefore in comparison with the force caused by pressure. However, this meets only a small number of practical cases and frictional errors cannot be ignored in the majority of applications.

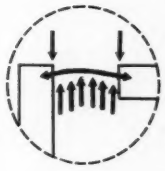
We shall therefore discuss a force balance servo

measuring capsule will at the same time reduce the errors brought about by friction"



Behavior of two different types of capsule

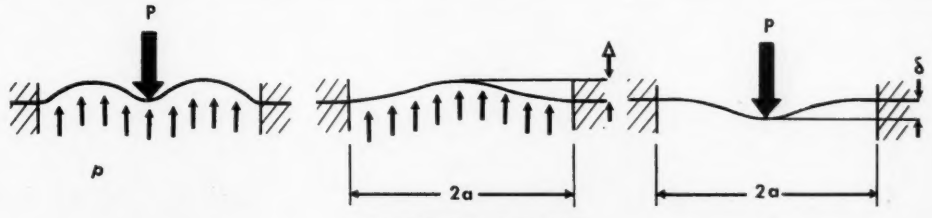
Fig. 6. Conventional and centre stiffened diaphragms (a) undeflected, (b) deflected by internal overpressure and (c) finally in force balance.



system which restores an elastic capsule to its original volume and so separates the measuring and the capsule elasticity. At the same time, normally occurring friction of the instrument movement can be greatly reduced (or almost eliminated) by a servo motor of suitable size.

Fig 3 shows the general arrangement of a force balance servo system. A flexible capsule is subjected to the unknown pressure, which affects its volume. The expansion of this capsule displaces an

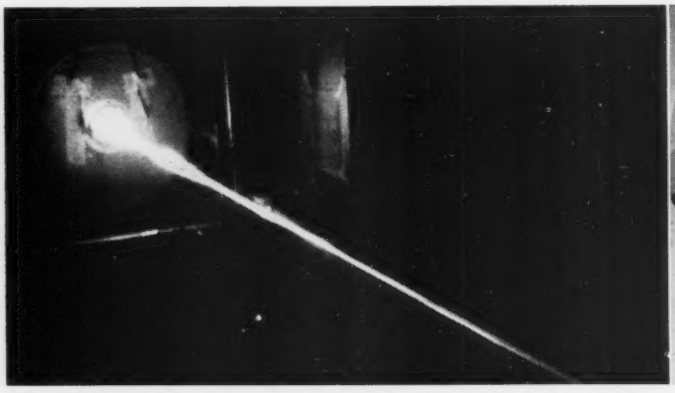
(Continued on page 84)



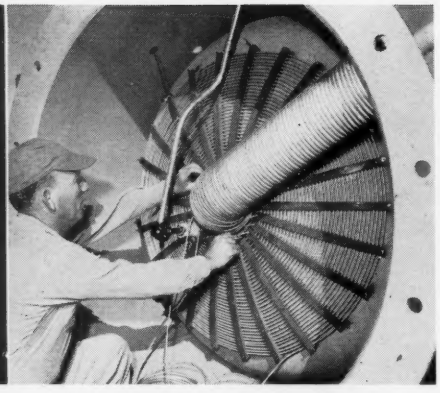
The deflection of a plate

Figs. 7a, b and c. Concentrated and distributed load problems are discussed in text.

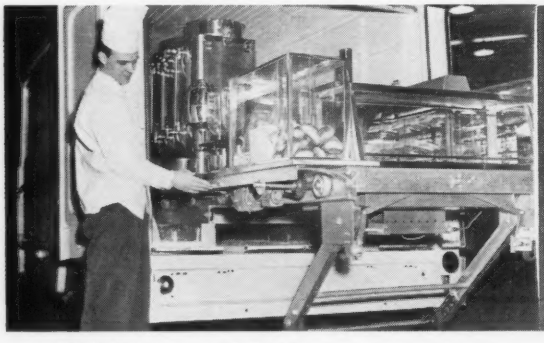
Design news in pictures



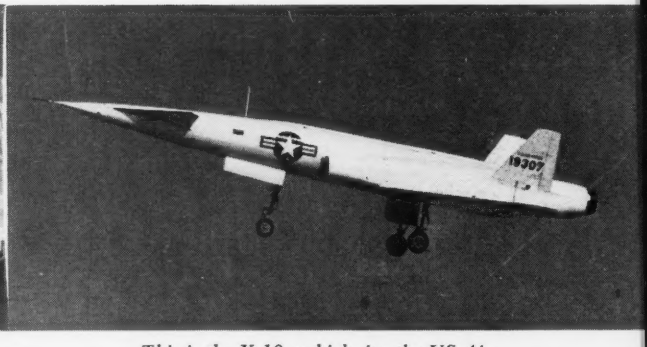
Light sufficient to take its own picture is generated by a model traveling at 10,000 mph after being fired from the new Ames Light-Gas Gun at the NACA's Ames Aeronautical Laboratory. Movement was left to right. (200)



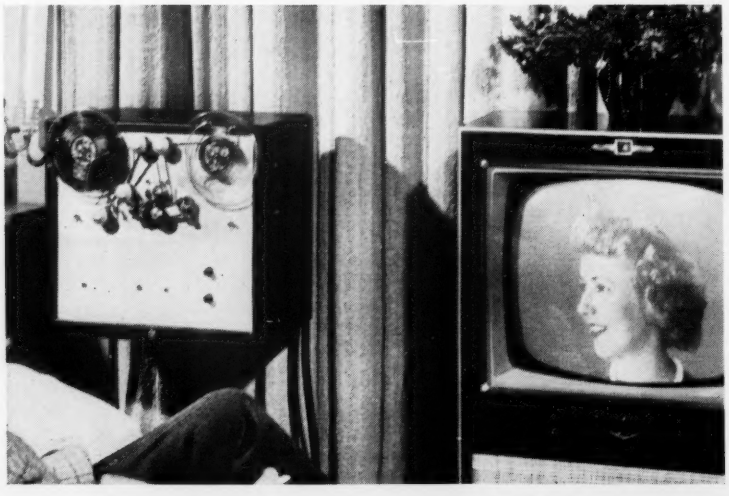
Induction heating coils are installed on the bottom of the main core vessel of the OMRE experimental nuclear poser reactor being built by Atomics International in Idaho. (201)



Push-button controls bring a cafeteria unit sliding from its van. In the same movement, aircraft-type landing gear folds out and down to hold the front unit steady as the rear rests in the van. (202)

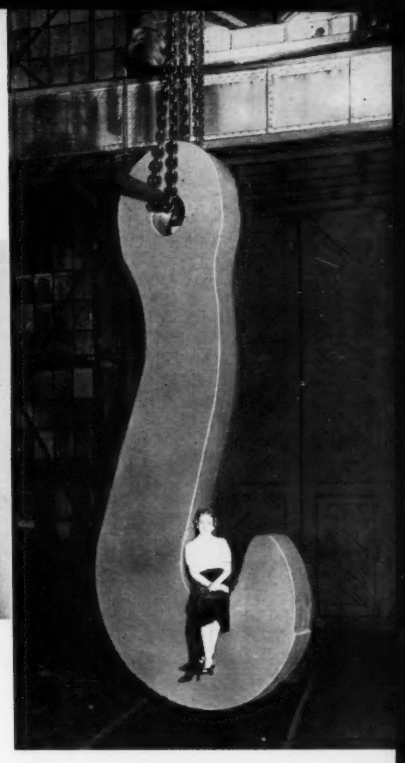


This is the X-10, vehicle for the US Air Force in the testing of an intercontinental guided missile weapon system programme. The unmanned plane has been flown at high supersonic speeds during test. (203)

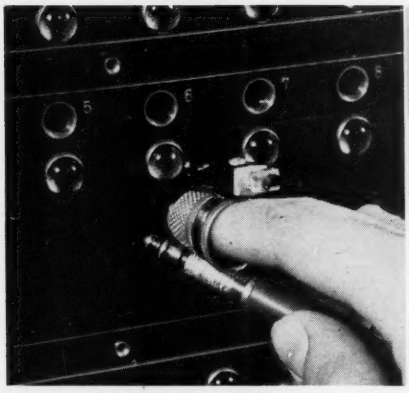


RCA's "Hear-see" tape player will play back pre-recorded TV programmes from magnetic tape over a standard receiver. (204)

Some modern designs making news today

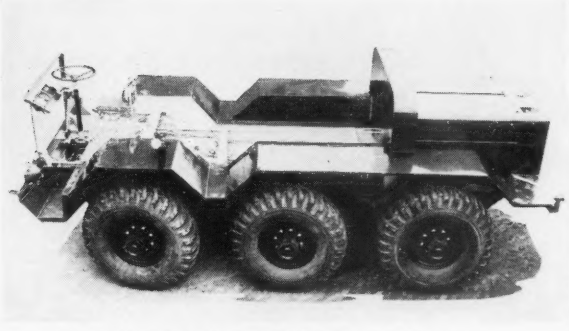


This hook is not so much for lifting blondes as for ladles on a 500-ton capacity crane. (205)



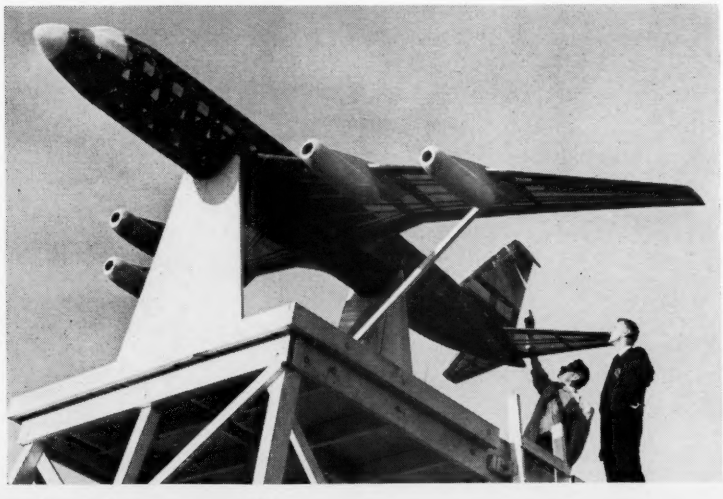
Close-up of electronic "eye" designed to aid blind operators of telephone switchboards. Finger-tip device detects the lamp marking the incoming call. (206)

The trigger operated alarm horn is able to sound a call that can be heard up to a mile away. It is Freon-powered and weighs less than a pound and a half. (207)



The Salamander has a Rolls Royce engine — rear mounted, five-speed free selective transmission and power steering. A six-wheel-drive system and independent wheel suspension makes the vehicle at home on any terrain. (208)

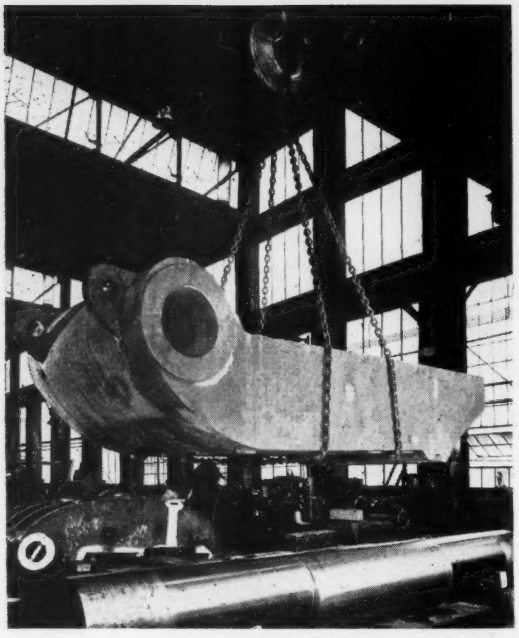
Perhaps the most interesting feature of Pontiac's "Club de Mer" is the body which is of anodized brushed aluminum. According to Pontiac the dorsal blade acts as "a stabilizing fin." (At high Mach numbers?) (209)



Convair engineers are proving the communication system for the 880 jet transport on this 17 ft wingspan model. (210)

A new weld invades the world of chainmaking

By increasing the weld area of the links a heavy-duty chain is stronger and becomes kink-free as well



A four-leg sling of X-Welded chain lifting 35,000 lb.

A feature which increases the weld area of heavy-duty industrial chains by 225%, and represents the first fundamental improvement in the chain industry since the advent of electric welding, has just been announced.

Known as X-Weld, the process also provides a chain that will not bend until more than 100% overload has been applied. (The name is derived from the weld pattern observed when a chain link made by this process is etched.)

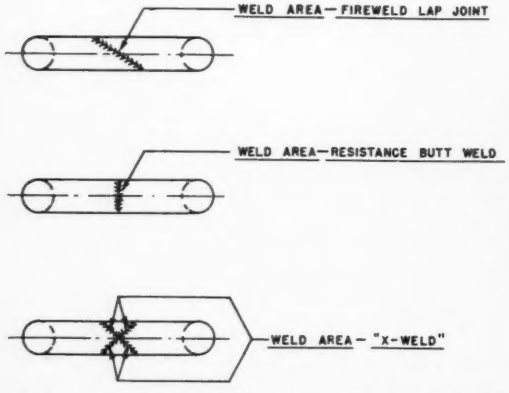
According to F. C. Cullimore, president of Dominion Chain Company Ltd., reaction from heavy industry in Canada has been overwhelmingly in favor of the much stronger X-Weld design. Most customers plan to use it exclusively as their older butt-welded chain wears out.

The additional weld area of this chain is obtained by inserting and welding two half round, diametrically opposed pieces of steel between the butted ends of conventionally formed chain link. The inserted metal lugs of full alloy strength become stops midway in the link, so that kinking is impossible and the chain always hangs straight.

Results of early installations (for slings, bundling, towing, booming and general utility use) reveal considerably greater service life for this chain than for the butt-welded types. Reports from oil field operators on boomer chains and from industry on chain slings have been particularly impressive.

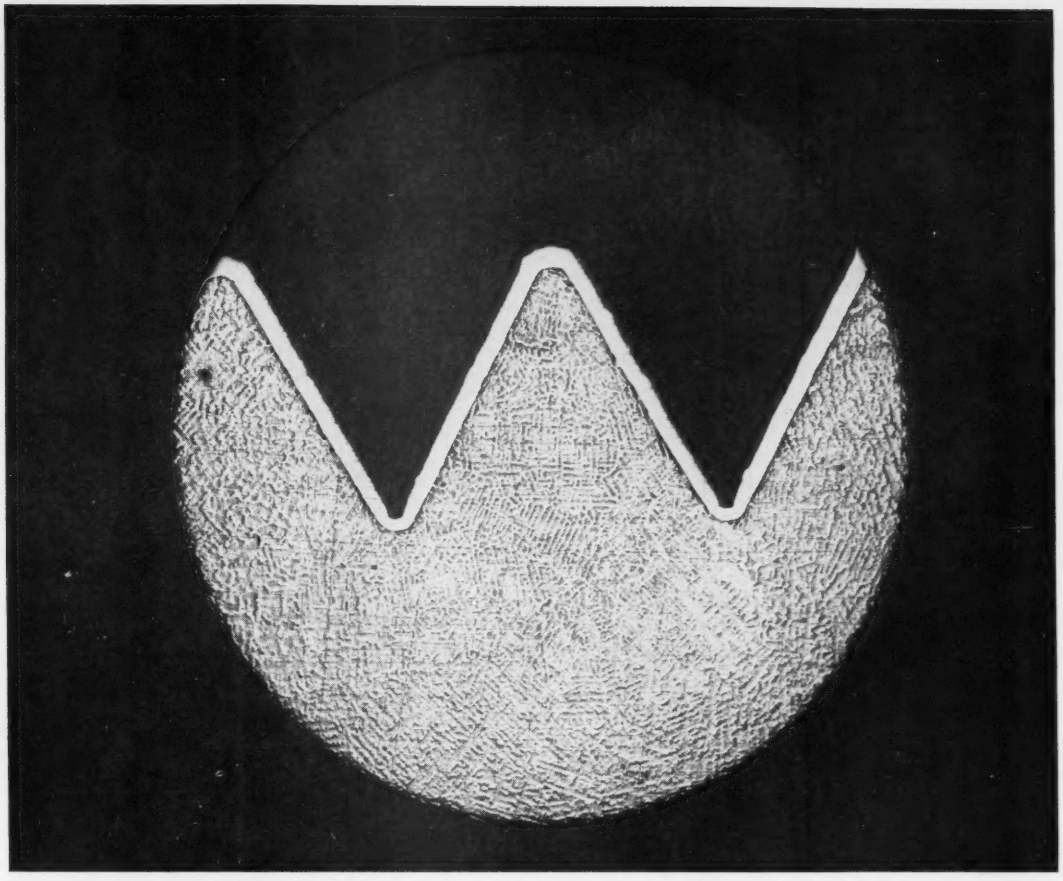
For high temperature use, an X-Weld chain is being manufactured in special analyses of stainless steel (Type 321) and super-stainless steel chain. The former will not begin to scale until temperatures of approximately 1,500 F have been reached. The super-stainless chain operates successfully in temperatures as high as 1,800 F. Both these materials stand up under the acids normally used in pickling.

Current production is in five sizes, from ¼ in. to ¾ in., with working loads up to 23,000 lb. ★



Weld area of the X-Weld link is 225% larger than the butt weld and ensures a much greater safety factor.

Close-up of the chain reveals the shaped lugs which have been fused between the butted ends of the link.



Photomicrograph at 165 diameters of the plating applied to low carbon steel. Note the uniformity of the coating.

Nickel plating by chemical reduction

This is a method of applying a nickel-phosphorus coating to metals without electricity

Readers who'll admit to being car owners in the early twenties probably recall the view from the driver's seat. Over a wood-rimmed wheel the eye ran the length of a tall hood to the feature which proclaimed loudest the car's make, the heavy nickel-plated radiator shell.

Lacking the tinsel glitter of 1957 chrome such radiators spoke in muted brilliance of a finish which, like the cars themselves, was built to last for an eternity.

Now, as in the twenties, a nickel coating rates highly as protection for many metals. Until recently a manufacturer had only the electroplating method for putting this finish on parts, and electroplating has some drawbacks. Now, however, another process (not new by any means) is generally available and its trade name, owned by General American Transportation Corp., is Kanigen.

Alco Products Inc. holds the exclusive rights for this process in Canada where it is trademarked Alcoplate.

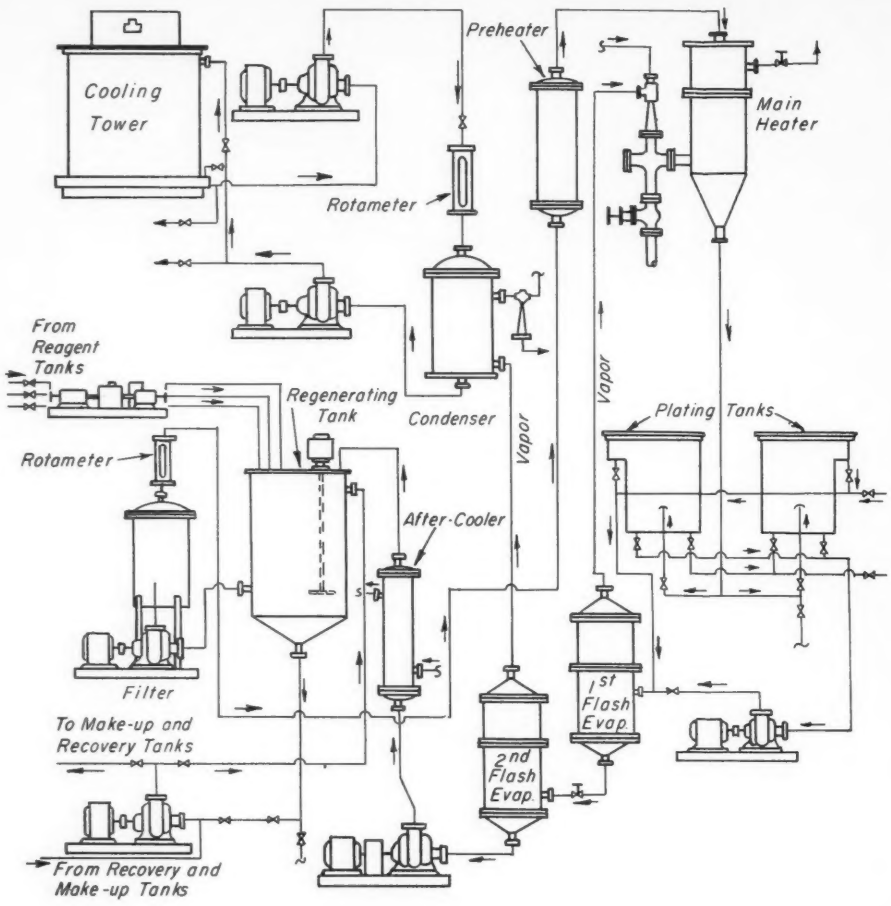
This plating process is not merely an alternative to electroplating. In many instances it offers some very solid advantages which are simply not available to the older method.

Nickel-plating by this method requires neither current nor electrodes and, since deposition takes place wherever the part is in contact with the plating solution, the "throwing power" of the bath is infinite and unaffected by complicated shapes.

Many small parts that the electroplater cannot handle are easily bulk barrel plated by the Kanigen process. The barrels can operate at speeds slow enough

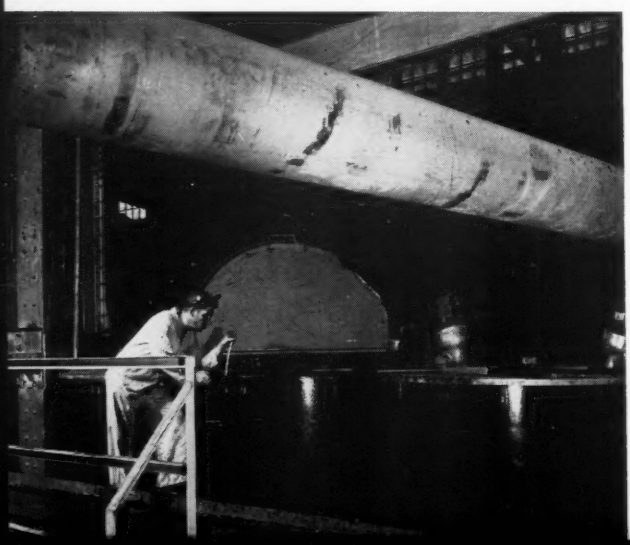
Some Facts on Kanigen

Specific gravity	7.9
(after 1 hr. heated over 400 deg. C)	7.8
Melting point	1635 deg. F (890 deg. C)
Electrical resitivity	60 micro-ohms/cm² (approx.)
Coefficient of expansion	13 x 10^{-6} cm/cm per deg. C or 7.22 x 10^{-6} in./in. per deg. F
Thermal conductivity	0.0105 to 0.0135 /cm sec. deg. C
Tensile strength	3% to 6% elongation, no stress failure



A flow diagram of the nickel plating process

A complete system for this method of electroless nickel plating is shown in diagram form.



to coat parts which cannot stand the high speed of the electroplater's barrel.

General American describes the Kanigen process in brief as "a method for depositing a uniform, hard, corrosion-resistant nickel-phosphorus coating on iron, copper or aluminum (and their alloys) from a chemical bath, without the use of electricity."

Basic reactions for the deposit of Kanigen are as follows:

(1) $Na\,H_2\,PO_2 + H_2O \longrightarrow NaH_2\,PO_3 + 2H$

(2) $Ni\,SO_4 + 2H \longrightarrow Ni^\circ + H_2SO_4$

(3) Combining 1 and 2

$Na\,H_2\,PO_2 + Ni\,SO_4 + H_2O \longrightarrow Na\,H_3\,PO_3 + Ni + H_2SO_4$

(4) $3\,Ni + 3H(H_2PO_2) \longrightarrow Ni_3P + H_2O$

Tanks used for immersion application of the nickel plating process at Alco's plant in Dunkirk, New York.

This is actually a simplified explanation of a process which is not completely understood. Nevertheless it is a fair description of the events that occur in continuous process.

Chemical analysis of Kanigen shows the make-up to be 91.3000% nickel, 8.7000% phosphorus, 0.0400% carbon, 0.0023% oxygen, 0.0047% nitrogen and 0.0016% hydrogen. Cobalt, aluminum, copper, manganese, iron, lead and silicon appear in very minute traces.

In plating, the coating actually grows from an infinite number of points on the surface metal. If this surface has been properly prepared the growth thickens into uniform coating regardless of the part's shape. If the surface to be plated is excessively rough some gas traps may form (hydrogen is evolved in the reaction) with the result that pores remain in the coating. To avoid this the parts must either be polished or a coating as thick as 0.001 in. to 0.002 in. applied. The coating itself has no crystalline structure and has zero porosity. When a Kanigen-coated steel part fails in the salt spray test the points of failure have no tendency to spread, enlarge or multiply—even after as much as 5,000 hours in the spray cabinet.

To get maximum wear out of parts that have been Kanigen coated it is best to heat them at about 1,380 deg F (750 deg C) for one hour. The normal hardness of the plate is 500 Vickers but heat treatment for five hours at the temperature mentioned gives maximum ductility and impact resistance. Salt spray resistance is also improved.

The adhesion of the nickel plate is excellent. General American claims values in the region of 30,000 to 60,000 psi to steel. The plating does not flake when samples are pulled to breaking point in tension.

Most of the alloys of iron, copper and aluminum take the Kanigen coating satisfactorily as do most thermoset plastics, glass and ceramic. Among the materials which cannot be satisfactorily plated are lead, cadmium, tin, bismuth and antimony, thus ruling out the coating of soldered or brazed parts which have used tin or lead solders.

So far, General American thinks that the largest field for Kanigen is in preventing iron contamination. So many materials, while they do not corrode steel themselves, pick up iron oxides which contaminate and discolor them. Obvious examples are to be found in screw conveyors for handling cake mixes, bakery dough troughs, gasoline tanks, chemical blending tanks and dry-cleaning equipment.

What about the plating process itself? Kanigen is applied by dipping parts in the plating solution or alternatively by pumping the solution through the parts if they are large and only require plating on the inside. As mentioned earlier, great care has to be taken to avoid gas traps. If these are found to exist they may have to be vented or the part design changed unless (as with circular vessels) the part can be rotated during immersion.

Small parts can be barrel-coated but larger parts necessarily have to be racked or wire hung during the plating. Care must be taken to hang the part by the least important areas although, generally speaking, parts held by wire will plate to 0.002 in. under the wire without a mark unless they are extremely heavy.

In the words of Gregoire Gutzeit of General American (a man who has played a large part in the development of Kanigen): "Any engineer blessed with imagination will find in his own field many possibilities that would make items with this coating preferable to those being used." ★

Corrosion Studies

of Kanigen Chemical Nickel Plating

All samples were run completely immersed in the corrosive solution with no aeration.

Material	penetration mils (0.001") per yr.
Amyl Acetate (9 wk. test—room temp.)	*
Amyl Alcohol (9 wk. test—room temp.)	*
Benzol (9 wk. test—room temp.)	*
Benzyl Acetate (9 wk. test—room temp.)	*
Benzyl Alcohol (4 wk. test—room temp.)	*
Carbon Disulphide (Dry and in presence of water)	*
Dibutyl Phthalate (8 wk. test—room temp.)	*
Ethyl Alcohol (9 wk. test—room temp.)	*
Glucose (five grades)	*
75% Iso Amyl Octyl Orthophosphate (3 wk. test—room temp.)	*
Methyl Alcohol (9 wk. test—room temp.)	*
Odorless Naphtha	*
Petroleum Sour Crude	*
Petroleum White Oil	*
Photographic Developer (4 wk. test)	*
Photographic Hypo (4 wk. test)	*
Refinery Brine Solution	*
Allyl Chloride (9 wk. test—room temp.)	0.02
Aluminum Sulfate—Saturated (4 wk. test—room temp.)	0.18
Ammoniated Ammonium Nitrate (4 months test)	0.31
Ammoniated Ammonium Nitrate Vapors (4 months test)	0.258
Ammonium Sulfate—Saturated (4 wk. test—room temp.)	0.04
Ammonium Sulfite—Saturated (4 wk. test—room temp.)	0.04
Amyl Chloride (9 wk. test—room temp.)	0.03
Black Liquor Skimmings (12 wk. test—room temp.)	0.01
3% Calcium Chloride (4 wk. test—room temp.)	0.21
5% Detergent Solution	0.037
Formaldehyde (16 wk. test—room temp.)	0.15
Gasoline	0.022
Hydrochloric Acid Solution pH 2.5 (4 wk. test—room temp.)	0.33
Hydrochloric Acid Solution pH 3.0 (4 wk. test—room temp.)	0.14
Hydrochloric Acid Solution pH 3.5 (4 wk. test—room temp.)	0.074
Hydrochloric Acid Solution pH 4.0 (4 wk. test—room temp.)	0.054
45% Lactic Acid	0.29
Lemon Juice	0.23
Oleic Acid (10 wk. test—room temp.)	0.012
Orange Juice	0.013
3% Sodium Chloride (4 wk. test—room temp.)	0.017
72% Sodium Hydroxide (16 wk. test—240°F.	0.069
Stearic Acid (70°C)	0.02
Tall Oil (Crude) (12 wk. test—room temp.)	0.031
50% Tanning Solution	0.048
Thionyl Chloride, Anhydrous	0.032
Water, Distilled (4 wk. test—room temp.)	0.029
5% Acetic Acid	0.791
Ammonium Hydroxide, 30% NH_3 (4 wk. test)	2.3
5% Ammonium Phosphate (140°F)	0.8
5% Citric Acid	0.97
Fluorophosphoric Acid	1.56
Hydrochloric Acid Solution pH 1.5 (4 wk. test—room temp.)	1.25
Hydrochloric Acid Solution pH 2.0 (4 wk. test—room temp.)	0.93
5% Sodium Cyanide (4 wk. test—room temp.)	0.52
1% Sulfuric Acid	1.12
5% Sulfuric Acid	1.83
10% Sulfuric Acid (4 wk. test—room temp.)	2.0
Monochloracetic Acid	†
Nitric Acid	†
85% Phosphoric Acid (140°F)	†
Wine (Sherry)	†

* No attack.

† Not recommended.

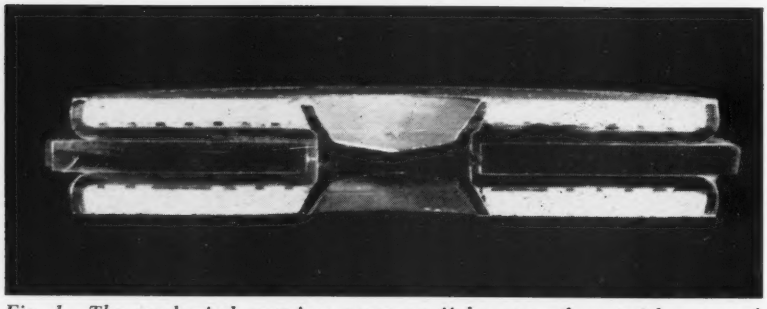


Fig. 1. The mechanical container necessary if low-strength materials are used.

Ceramics adapt to the friction field

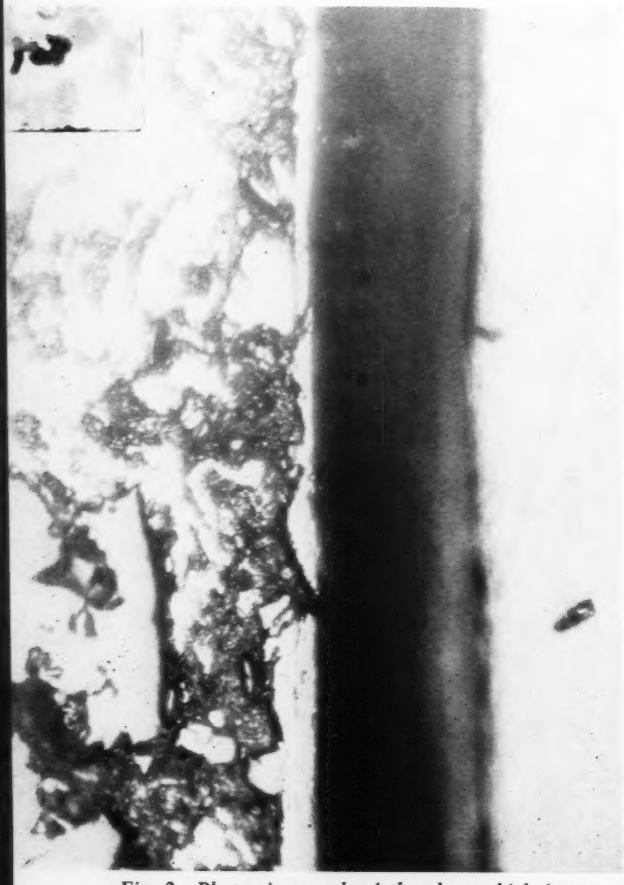


Fig. 2. Photomicrograph of the glaze which forms on the on metal-ceramic materials after many applications.

The high landing speeds of today's jet aircraft coupled with the need for reduced wheel and brake space is just one reason for the emphasis placed on the cerametallic materials

Cerametallic friction material is a composition of ceramic and metal particles for which Bendix has adopted the trade name Cerametalix.

This article gives a short history of the material and the reasons for its development. The basic theories that influenced its design and development are stated, as well as a comparison of its characteristics with those considered desirable for any friction material.

The material is not new; rather it is the result of 10 years' development. A review of activity in the aircraft brake development field indicates that 90% of the firm's dynamometer testing was alloted to improvement of friction materials. Moreover, from 1940 to 1945, only 20% improvement in lining heat capacity resulted.

From this relatively small accomplished gain with organic materials, together with the advent of the jet-powered airplane (with its higher landing speeds, and the need for reduced wheel and brake space) it was obvious that future demands could not be met with organic friction materials. Fig. 3 shows the increasing capacity requirements for aircraft wheels and brakes. While the wheel load carrying capacity increased 3.5

"Over the past eight years extensive research has been going on."

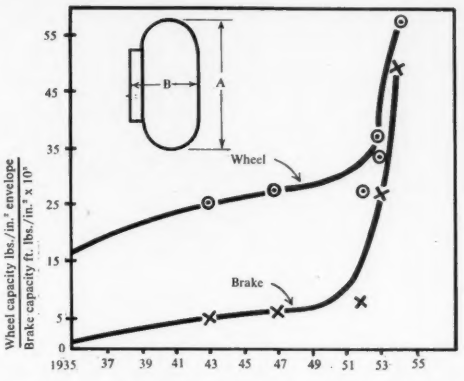


Fig. 3. The requirements of wheel and brake.

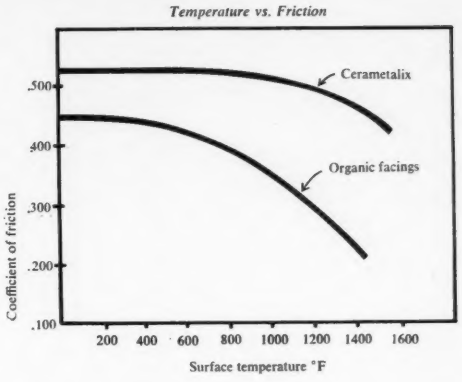


Fig. 4. Comparison with conventional linings.

times, the brake energy capacity increased 34 times. Such increases in capacity have been realized through improved design, better use of space and better materials. Cerametalix linings have played a very important role in this progress.

In 1945 the manufacturers who supplied friction material for aircraft brakes began to develop a new friction material with inorganic ingredients which would not deteriorate at temperatures under 2,000 F. It was thought that such a material would stand a much better chance of meeting future requirements. Tests had previously been run on the best organic material, to determine the cause of apparent wear. These tests proved that lining wear was not a linear function of the work done, but was determined largely by the resulting flash and soak temperatures. The indications were that 20% of the lining wear resulted from work done, 40% from the very high flash temperatures and 40% from the soak temperatures after a stop. It was therefore reasoned that a material which could operate continuously at temperatures in excess of these soak and flash temperatures without deterioration would outwear by five times the material then being used.

The friction material manufacturers considered this an unsound approach, as a result of their experience with the brittleness, low strength and galling (or scoring) tendencies of such materials. Bendix were not convinced of the impossibility of such a program, however, and with a specially designed press tester, made an exploratory study. Although there were many disappointments during the first year of testing, a development program was initiated and has continued on a constantly increasing budget for the past 10 years.

In early attempts to produce an inorganic friction material, such things as silica sand, glass formations, firebrick, cement, ashes and plaster of paris were used. All the warnings of the inherent brittleness and low strength were borne out in the tests of annular samples; these usually distintegrated after six applications. There was no evidence, however, that early failures were caused because the material could not survive the high temperatures. A high, stable coefficient of friction also resulted. A metallic matrix was introduced to support the ceramic particles and conduct heat from the surfaces, while a metal cage was added to give strength to the contained material.

Over the past eight years an extensive research program has been going on under the following general classifications:

1. Investigation of compounds using all the basic ceramic materials in combination with a metallic matrix within a metal cage.
2. Combining the compounds, so that no matter what the temperature in operation it would be impossible to fuse the lining material to the opposing surface.
3. All materials used in the mix chosen so that they would not deteriorate under operating temperatures of 2,000 F.

This program has shown that the addition of a metallic matrix not only gives the necessary thermal shock resistance, but also produces an ideal wearing surface, through the formation of a spinel on the surface.

A good friction material should have all these properties:

1. Adequate mechanical strength at all operating temperatures.
2. Temperature and thermal shock resistance.
3. High heat-absorbing capacity, that is, high specific gravity, specific heat and thermal conductivity.
4. High and consistent coefficient of friction.
5. Low wear rate.
6. Smooth engaging characteristics.
7. Compatibility with mating surfaces (minimum galling, wear and heat checking).
8. Nonfusible with opposing surface.
9. Noncombustible.

Naturally, no single type of friction material excels in all these properties. The advantages of Cerametalix lining are covered in the following itemized comparison of its properties and those of other conventional linings.

This friction material is not new, but rather the result of ten years of development

The lining uses ceramic materials within a metallic matrix and is unlike conventional lining materials, which must sacrifice the desirable friction properties of this type of material in order to obtain mechanical strength. The mechanical container design shown in fig. 1 is also necessary in allowing the use of these inherently low-strength materials.

No structural change (or other permanent damage) occurs in the lining due to high surface temperatures, because the lining is heat-treated during processing at higher temperatures than the normally encountered soak temperature during use. Actually, high surface temperatures tend to improve its stability and wear properties. Surface cracks occasionally develop in the glaze surface formation, but no structural damage results.

The heat-absorbing properties are superior to those of an organic bonded lining, since the specific heat, specific weight and thermal conductivity are all higher. The conventional metallic facings have similar heat-absorbing properties, but their more limited heat resistance reduces their effectiveness as a heat reservoir.

A high coefficient of friction is generally desirable, and a constant coefficient of friction is essential, for good performance. This lining (with the proper selection of ceramic and its heat-resistant properties) is more consistent and fade-resistant than conventional organic or powdered metal linings. The curve of coefficient of friction vs surface temperature (fig. 4) shows the comparison with conventional lining materials, recorded during a controlled button test.

Metal-ceramic friction materials in general tend to decrease their coefficient of friction with repeated applications, due to a glazing of the surface. Fig. 2 shows a photomicrograph of this glaze. This problem has largely been eliminated by the development of ceramic materials and additives to control the glaze formation.

The linings have demonstrated a wear life of from 3 to 10 times that of conventional linings (fig. 5). This long-wear life is attributed to the high temperature strength, the proper surface glaze and the superior wear resistance of ceramic particles in the metal matrix of Cerametalix linings. Fig. 6 compares the wear rates with those of conventional linings at various temperatures.

The surface glaze affects all the friction properties of the lining, but the most desirable effect is that of reducing wear. One of the major developments has been to find the ingredients to promote the glaze formation and to control its effect on other properties of the material.

The wear rate is also controlled by the amount of ceramic material incorporated in the lining. Almost any refractory ceramic will accomplish the wear reduction, but the specific ceramic to produce the desired friction properties is critical. Torque curves taken from the clutch and brake dynamometers show the consistent torque obtainable through the proper selection of ingredients in the friction material.

The rigid nature of the lining (particularly at higher temperatures) may promote more aggressive engaging characteristics, due to irregularities at the friction surfaces, than the more resilient, organic bonded lining. However, by the control of torque characteristics through lining composition and by proper design of the friction device, good engaging characteristics have been obtained in most of the applications of cerametallics.

Good mating surface conditions also may be attributed to the proper glaze formation. The glaze tends to eliminate the transfer of matrix material to the opposing surface which initially had caused galling of the surfaces. Cerametalix lining lessens the heat checking of the surface. The hardness of the glaze formation suggests that the opposing surface should be relatively as hard (like strength cast iron and hardened steel). ★

"They show a wear life 3 to 10 times that of conventional linings."

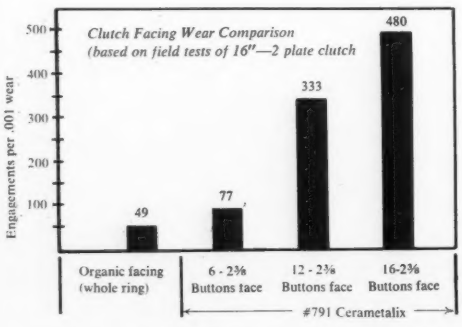


Fig. 5. Metal-ceramic material life is high.

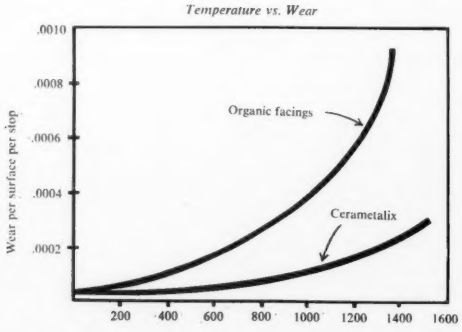
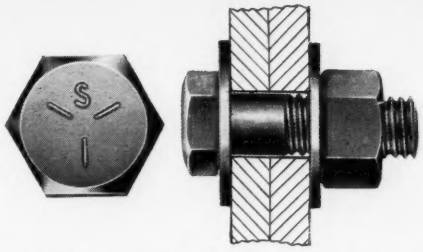


Fig. 6. A comparison of the two wear rates.

Why use a high tensile bolt?

It offers many savings over the rivet. savings in time, labour and inspection



Marking on head of Stelco's high-strength bolt means it meets Specification A-325.

The basic principle of the high tensile bolt is to clamp the joint together so tightly that the strength of the joint depends on the non-slipping of the contact surfaces of the clamped material. There is no attempt to fill the hole entirely or to develop the bolt in bearing or shear. It is entirely a tension member, although it has high shear and bearing values if these should be required.

Experimental work shows that bolts that are properly tightened have greater strength than rivets in a structural joint. However, because of the very high clamping force required, it is necessary to use bolts of sufficient strength to allow the development of the proper tension in the fastener. Bolts made to ASTM specification A-325 meet this requirement.

Because of the strength required in the bolt (and nut) it is necessary to provide a hardened washer under the head (and under the nut) to protect the structural members. By using washers, the load is distributed over a greater area; this prevents crushing of the softer structural steel under the bolt head and nut.

Tests have been made with similar joints, some bolted and some riveted. They show that, when tested to destruction, the riveted connection breaks through the line of holes, while the bolted joint breaks outside the line of washers. In effect, the bolts form the strongest part of the assembly.

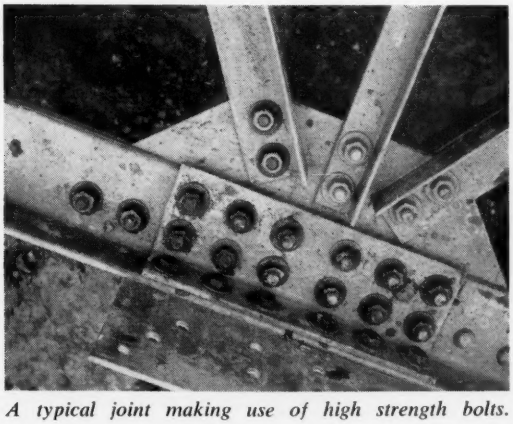
It has been established that 90% of the proof load of the bolt gives enough tension in the fastener for sufficient friction to be developed between the members. This is the mininum tension; it is recommended that the actual tightening be such that the tension is approximately 15% higher so all bolts are properly stressed.

In the usual methods of tightening bolts, the stress in the bolt is measured as a function of the torque applied to the nut. The relationship between the applied torque and the tension in the bolt depends upon the characteristics of the material and the apparatus used in tightening. It is accurate only within broad limits. The practice of tightening beyond the required minimum provides ample compensation for the inaccuracies of the method.

It should be kept in mind that whilst there is a minimum tension required, there is no maximum (short of breaking the bolt). It is a common belief that bolts lose their load-carrying capacity when stressed beyond their yield point. This is not the case. Bolts stressed into the plastic range are more effective than those stressed below the yield point, principally because there is a 70% reserve strength between proof load (yield point approximately) and the ultimate strength of any fastener. Tests have proved that bolts stressed beyond the proof load retain their tension and show no reduction in clamping force.

Furthermore, it is easily shown that additional loads applied to the joint do not increase the tension in the bolts, until the stresses due to exterior loads equal the tension stresses induced by torquing.

Advantages claimed for high strength bolts are: Higher tensile strength; greater fatigue resistance; 2-man bolting crews, rather than 4-man riveting crews; faster erection; three bolts can be installed as fast as one rivet; much less equipment required; less installation noise; less hazard during erection; superior vibration resistance; 90% less inspection required; easier maintenance. ★



A typical joint making use of high strength bolts.

Pneumatic impact wrench drives home each Stelco bolt.

An intricate bilge pump casing and cover sand cast in the new aluminum bronze alloy which is known as Superston 40.

Britons give us a new aluminum bronze

A new alloy with better casting and mechanical properties than conventional bronze

The difficulties involved in casting the aluminum bronzes have limited their use, for without proper foundry practice considerable dross is formed in melting and can cause dirty castings with poor surfaces. (Klement and Birch in "Metal Progress.")

Recently, a new high-strength, copper-base alloy (called Superston 40) was developed in England by J. Stone & Co. (Holdings) Ltd. having better castability and more attractive mechanical properties than the conventional bronzes. Thin vanes, for example, flow readily and the improved solidification and feeding characteristics ensure soundness in very heavy sections. The alloy melts at a low temperature and can be readily forged, rolled or extruded.

Superston 40 is a two-phase alloy whose nominal composition is 12% manganese, 8% aluminum, 3% iron, 2% nickel and the remainder copper. As with commercial aluminum bronzes, small amounts of lead (up to 0.4%) have been found to improve the machinability, with a corresponding loss of strength and impact values. Since the machinability of the base alloy is adequate (it is generally equal to aluminum bronzes of comparable strength), the addition of lead and other minor elements is preferably held to a minimum to get the best resistance to corrosion and best welding characteristics.

The composition of the various bronzes is shown in Table 1 and the average mechanical properties of static sand castings in Table 2. It is obvious that the new alloy has the best combination of strength, ductility and toughness. Like most materials, Superston 40 responds readily to the advantages of centrifugal casting whereupon its mechanical properties are somewhat improved over the static cast values. The average tensile strength of centrifugal castings is 105,000 psi, yield strength, 50,000

Alloy	ASTM Designation	Cu	Al	Fe	Mn	Zn	Ni
Manganese bronze	B 147-52 Alloy 8A	58.0	1.25	1.25	0.25	39.25	...
Manganese bronze	B 147-52 Alloy 8C	62.0	5.5	3.0	3.5	26.0	...
Aluminum bronze	B 148-52 Alloy 9C	86.0	10.0	4.0	.....	.....	...
Nickel-aluminum bronze	B 148-52 Alloy 9D	79.0	11.0	5.0	.....	.....	5.0
Superston 40	.....	75.0	8.0	3.0	12.0	.....	2.0

Table 1
Composition of the various bronzes

	Tensile strength, (psi)	Yield strength, (psi)	Elongation (%)	Reduction of area (%)	Brinell hardness	Izod impact, (ft-lb.)	Fatigue strength, (psi)
Alloy 8A	70,000	23,000	30	30	125	25	16,000
Alloy 8C	115,000	70,000	15	15	210	12	20,000
Alloy 9C	75,000	35,000	18	15	155	15	29,000
Alloy 9D	95,000	45,000	7	7	195	9	30,000
Superston 40	98,000	48,000	26	28	185	25	33,000

Table 2
Average mechanical properties of static sand castings

	Condition	Tensile strength, (psi)	Yield strength, (psi)	Elongation, (%)	Brinell hardness
Alloy 8C	As cast	115,000	70,000	15	210
Alloy 9D	Heat treated	115,000	70,000	5	235
Superston 40	Heat treated	125,000	75,000	12	255

Table 3
Mechanical properties after heat treatment

psi and elongation and reduction of area 30%. Centrifugal castings up to 20 in. diameter, 12 ft long and 3 in. thick have been successfully produced.

The new alloy, like other high-strength aluminum bronzes, can be heat treated to higher strengths with some sacrifice in ductility. Its mechanical properties after heat treatment are shown in Table 3.

A number of interesting applications for both the cast and wrought alloy have been developed. The intricate bilge pump casing and cover shown in fig. 1 indicate the excellent castability obtainable. The 2 in. Y-valve (shown in fig. 2) is used to control the continual flow of 70% sulphuric acid at 120 F.

The excellent fluidity of the alloy apparent during casting has also been found in welding. Welds can be made with metal-arc, tungsten-arc, carbon-arc and consumable electrodes with equal success. They are dense, fine-grained and their color matches that of the parent metal. Welds will withstand a 150-deg flat bend and the average mechanical properties of all-weld-metal tensile specimens are: tensile strength 98,000 psi, yield strength 50,000 psi and elongation 20%. ★

Superston valve pipes 70% sulphuric acid at 120 deg. F.

Ideas round-up

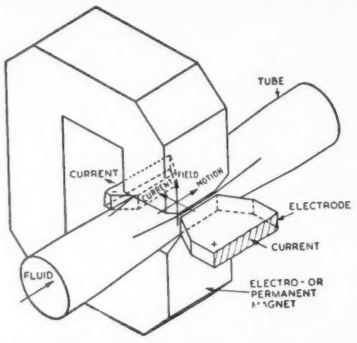
Moving liquid metals with an electro-magnetic pump

The use of liquid metals as coolants in nuclear power generation calls for a special type of pumping equipment and the electro-magnetic type has been found by the International Rectifier Corporation to be very satisfactory (according to their News bulletin). These pumps will handle such metals as sodium, sodium-potassium and lithium as well as bismuth, which may also be used to take advantage of its special properties, such as low neutron absorption cross-section and ability to dissolve uranium.

Bismuth (with its high density, viscosity and resistivity) can be handled very well by a dc conduction pump. The choice of pump (that is, ac or dc operated) depends upon the characteristics of the liquid metal and the pumping requirements.

The dc pump requires fairly heavy electrode currents at very low voltages. For example, a 100 hp pump of recent design required 100,000 amps at 2.5 volts and had an efficiency of about 40%. Current requirements are smaller when ac excitation is used, but the pump design becomes more complex and the efficiency decreases, particularly in the larger sizes.

The operating principle of the dc conduction pump is similar to that of a motor. Current from an outside source passes via two electrodes through the liquid. A field is produced by an electro-magnet (or permanent magnet) and the resulting force causes the liquid to move along the tube. This is shown in the diagram.



Basic arrangement of the dc conduction pump.

To obtain the advantages of the dc type pump, a rectifier may be selected which will handle these low voltage, high current demands with maximum efficiency and reliability.

Germanium power rectifiers are well suited for these requirements due to their ability to rectify very high currents at low voltages, with high rectification efficiencies. (211)

It shows you who? — when? — or how long?

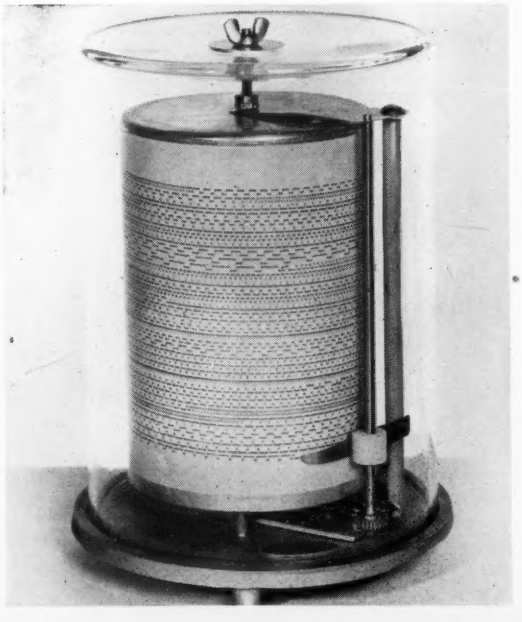
A compact operations (or events) recorder (Model MD-jr, made by Gorrell and Gorrell) consists of a drum that rotates at any speed from 4 min to 24 hr per turn (as ordered). It is used graphically to record when a machine (or device) is operating or when an operator is producing. It shows . . . who, . . . when, . . . or for how long.

No ink is used. A stylus rests against the chart paper which has an adherent layer of white opaque wax crystals. The pressure of the stylus exposes the strongly contrasting color of the paper beneath.

The stylus produces a slight spiral tracing on the chart. The lead screw is also subject to an axial motion from a magnet (responding to the input signal) to cause a vertical line. By this means, more than 400 linear inches of clear, accurate recording can be obtained on a waterproof, easily filed chart 6 in. by 14 in.

When the 24 hr rotation model is used, any given instant in successive days can be compared, since the values line up vertically. Other drum speeds are 4, 5, 15 and 60 min as well as 2, 6, 12 or 24 hours. Motors operate on 115 or 220 volt ac. A 5,000 ohm electronic coil is available.

The clear transparent cover prevents tampering, keeps out dust and (most important of all) permits the worker to see his own production record. (212)



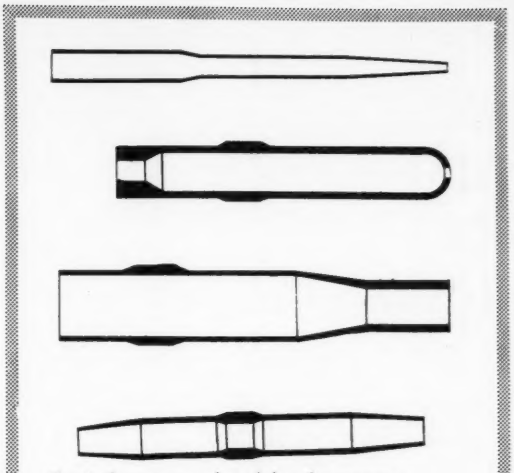
Cold-flowing metals into tubular forms

A process for cold flowing various metals into tubular forms of all sizes and shapes has recently been developed by Claude C. Slate Company. It was originally developed to meet the demand for high production where finishes and dimensional tolerances could only be held by expensive machining and polishing practices.

The demand for its use has been great because the time-consuming hours of machining have been eliminated, the scrap produced is infinitesimal, and burring, polishing and honing have been done away with.

Cylindrical sections may be formed with heavy wall thicknesses at the end or in the centre to provide for threads, bearings or other applications. These heavy sections may have the same OD as the tube body with a smaller ID, or a larger OD than the body with the same ID or both of these conditions may be formed. It is also possible to maintain the same wall thicknesses with smaller or larger diameters on the same tube. Laminated tubular sections of different material (with a thermal insulating material between) may be formed. Many configurations are available to the engineer such as airfoil sections for helicopter blades, missile wings or scope housings.

The increase in material strength by cold flowing the material enables the engineer in some cases to eliminate the necessity for heat-treating the part. This method of forming greatly refines the grain, with a resulting increase in ultimate tensile strength. Metals already in the heat-treated state can also be cold worked, thereby adding still greater strength to the part. An increase in strength of non-heat-treatable metals also results from cold flowing the material. (213)



Typical parts produced by the process.

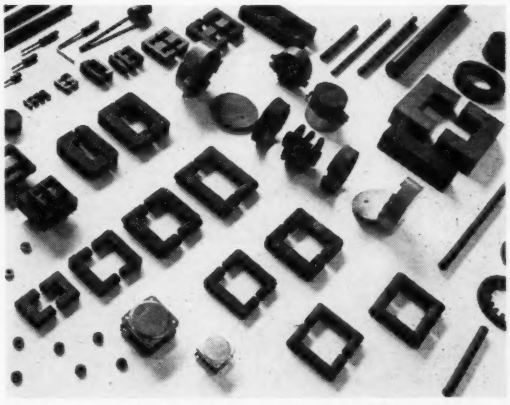
Ferrites — the grey matter in electronic brains

A group of black ceramic-iron products with unusual electrical properties (known as ferrites) form the memory cells in electronic brains, focus pictures on TV screens and cut the cost and size of many types of electronic equipment.

Five years ago Canada's total annual consumption of ferrites amounted to only a few hundred pounds. Today, it is around 300 tons and growing by leaps and bounds. One reason for the increase is the trend toward higher and higher frequencies in communications equipment. Another has been the broader appreciation among electronics engineers of the particular electrical properties of ferrites. Used mainly as core materials in transformers and filters, they are of great value to the electronics industry, because of their ability to step-up (or step-down) the voltages of high frequency currents, without any noticeable loss in energy. Earlier types of coil were relatively heavy, dear and inefficient. They were made from laminations of metal coated with varnish (or powdered metal) bonded together by an insulating substance. Coils made with ferrites are only one third the size and weigh only a few ounces.

The ferrites supplied by Rogers Electronic Tubes and Components are now used as core materials in long distance telephone apparatus, in military communications sets and in high-frequency power transformers for many types of electronic equipment designed for science and industry. Giant electronic computers, meanwhile, rely on ferrites for their memories. The brain cells in these machines are tiny rings of ferrite, laced with vertical and horizontal wires. Electrical impulses magnetize the cores so that they are able to hold or play back information like an electronic tape recorder.

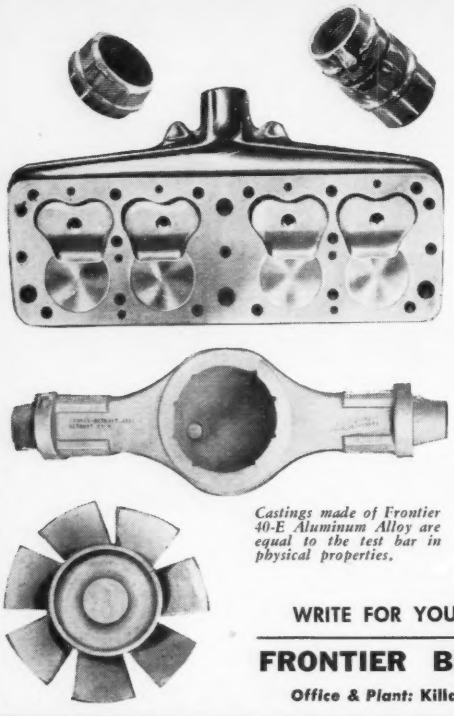
They are compounded from manganese dioxide, magnesium oxide, iron oxide, nickel oxide and zinc oxide. Each basic type uses three or more of these ingredients, mixed in various proportions to supply different grades for special applications. Like other ceramics, ferrites are not easily machined; they must be molded to form the scores of peculiar shapes demanded by equipment designers. A shrinkage of 10%



Ferrites can be molded into many different shapes.

Continued on page 78

A Modern Foundry ready to Serve You



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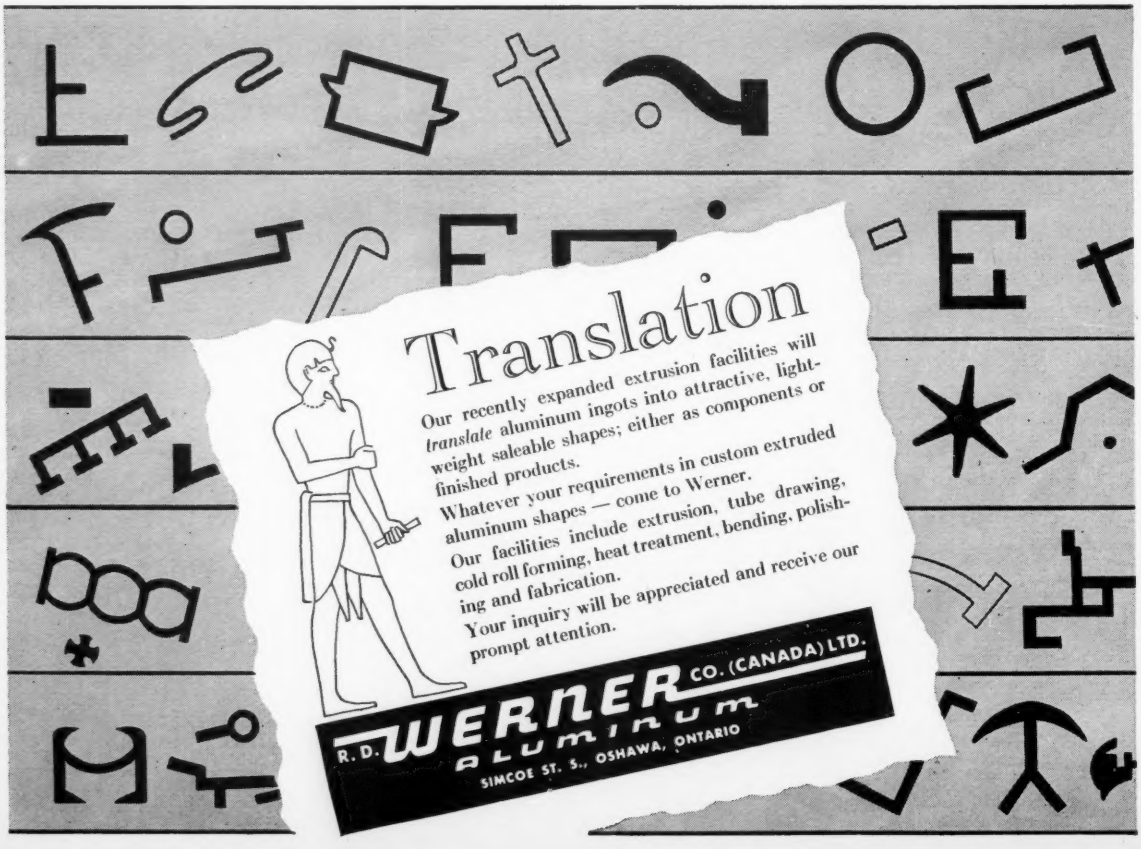
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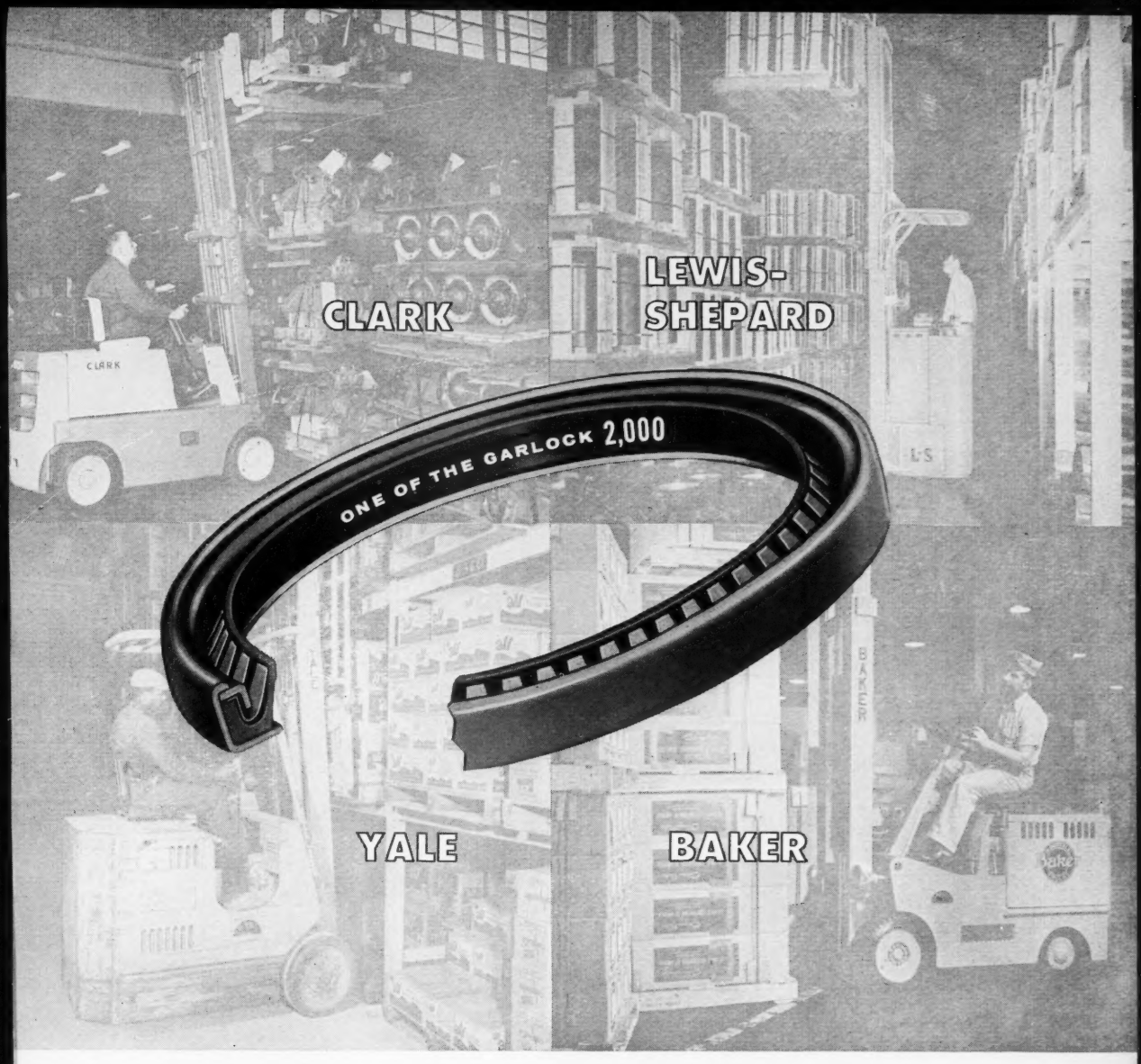

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The standard sealing element in a Garlock KLOZURE Oil Seal is a unique synthetic material molded to very accurate dimensions. It is non-abrasive, free-running; oil, grease, heat, and cold resistant; impervious to water, mild acids, and alkalies. It is also extremely durable and resilient.

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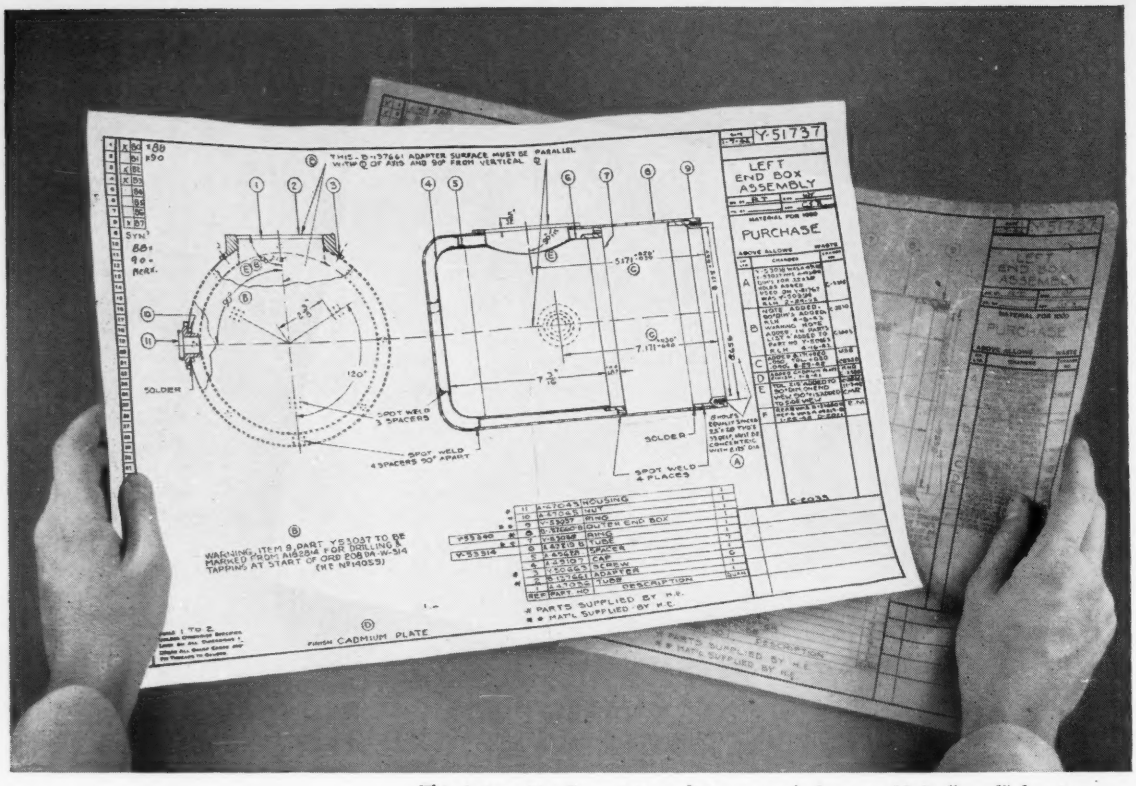

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New products & materials

New items which can help you on the job

Flexible foams

A new six-page folder, describing the use of Nafil resin for making polyurethane foam, is described in a folder from **Chase Chemical Corporation.**

The foam can be produced in various densities and consistencies by mixing the resin and the correct catalyst. The two components can be mixed by hand or by machine and can be spray or pour applied.

This foam sets and cures at room temperature and is ideal for acoustical treatment, buoyancy, cushioning, thermal insulation, potting, sound deadening, void filling and structural reinforcement.

Nafil components can be supplied to produce strong, tough, stable, rigid, semi-rigid and flexible foams having densities of 2 to 20 lb per cu ft. The physical characteristics of the foam can be varied to produce a foam most suited to the use for which it is intended. (221)

Sleeving cutter

A compact, bench-type tool of high capacity has been introduced by **D. G. Macdonald and Co.** It cuts all types of insulation tubing (including fibre glass and silicon-coated nylon, as well as small wire and solder) in lengths ranging from 1/32 in. to 2 in.

When in operation, the tubing is fed automatically right off the reel through the machine and the cut pieces are ejected on the other side, to be collected in a small box or receptacle. Its cutting job is razor-like. There are no crushed pieces or spoilage. This new tool (called "Little Joe") eliminates other expensive methods of sleeve cutting, and its cost-savings are tremendous because its production rate can reach 10,000 pieces per hour. It takes any size of tubing up to ¼ in. OD.

Little Joe is designed for bench mounting through the use of two screws and is quite compact (5 in. wide, 5½ in. deep and 6 in. high). All vital moving parts are of case-hardened steel and the cutting knife (which can easily be removed for resharpening or replacement) is of high-speed steel. (222)

Diaphragm compressors

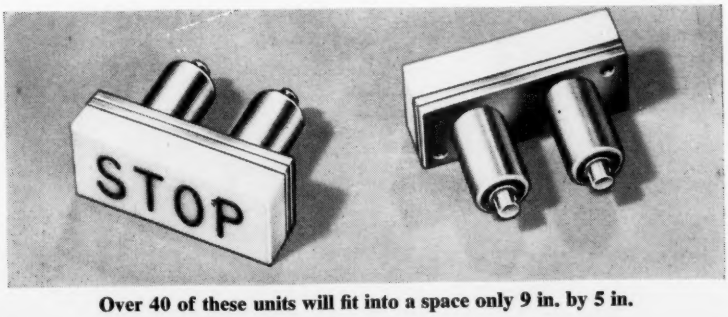
Following the success of their range of small diaphragm compressors, the **Hymatic Engineering Co. Ltd.** have developed a twin-cylinder unit (Type DP14) capable of continuous operation at pressures up to 50 psi. It will find many applications where the supply of absolutely clean air is essential, particularly in the food and brewing industries and for the pressurization of radar and electronic equipment.

To provide contamination-free air, multi-ply high-temperature neoprene diaphragms laminated with nylon are used. Unlike the smaller Hymatic compressors, the DP.14 is suitable also for closed circuit applications, because both delivery and suction valves are positioned on the same side of the compression diaphragm. Of simple stainless steel, reed type, these valves are identical.

Free air delivery at 1,500 rpm is between 7 cfm (at 45 psi) and 9 cfm (at 10 psi), the hp requirements for the belt drive being not more than 1.5. The compressor can be supplied integrated with a 400/440-volt, three-phase electric motor. A clutch or venturi type unloader can be fitted for starting against load. (223)

Indicator light

A twin-lamp rectangular indicator light (Type L5500) developed by **Hetherington, Inc.** is virtually a miniature "billboard" containing abbreviations, words or entire phrases engraved on its 1⅜ in. by 9/16 in. plastic lens face. Designed for aircraft and industrial control and annunciator panels, it allows quick, accurate comprehension of the illuminated "message" without the need for interpreting the meaning of tiny individual lights.



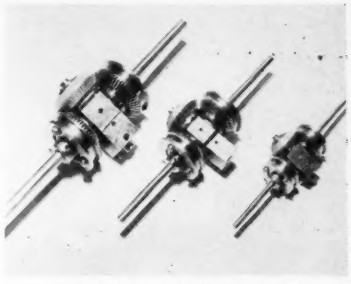
Over 40 of these units will fit into a space only 9 in. by 5 in.

In spite of its large illuminated area, over 40 of these rectangular units will fit comfortably into a space only 9 in. long by 5 in. high. The lens face is evenly back-lighted by two AN 3140 lamps, both easily replaced from the front of the panel. In addition, the two lamps act as a safety check should one burn out. The body of the assembly (of anodized aluminum) is mounted by two machine screws. Lenses are available in amber, blue, green, red or white translucent plastic. (224)

Differentials

A new line of inexpensive, precision, oilless bearing differentials are offered by **PIC Design Corporation.**

All parts are of stainless steel, except



All parts are stainless steel

the aluminum spider gear. The unit is black anodized. Lost motion between any two end gears is not more than 30 min of arc. It features a removable clamp ring for assembling end gears.

Available for immediate delivery: ⅛, 3/16 and ¼ in. shafts, 72, 64 and 48 pitch. (225)

Foundry sand scores

An injection kit for use in hardening foundry cores and molds with carbon dioxide gas has been announced by **National Cylinder Gas Co.** It consists of a Torchweld two-stage, carbon dioxide regulator, 15 ft of ¼-in. hose, a hand-operated valve, quick-change couplings, two sizes of interchangeable rubber plunger cups, steel injection tube and all necessary fittings.

The injection equipment contained in this kit is used to blow carbon dioxide into core sand mixed with a sodium silicate-bonded binder, causing the mixture to harden in a few seconds. The carbon dioxide reacts with the sodium silicate to form a gel that coats the core sand grains and hardens the cores. Advantages of the process:

(1) Elimination of core baking saves time, cuts core costs.
(2) No core driers are needed.
(3) Cores are accurate, need little finishing.
(4) Need for core plates and wire is reduced.
(5) Cores generally require less ramming.

(Continued overleaf)

New Products
Continued

(6) Excessive moisture pick-up is eliminated.
(7) Capital investment is reduced with no core-ovens or core-oven racks needed.
(8) Present sand-mixing equipment is suitable for silicate-bonded core sand treated with carbon dioxide. (226)

Centrifugal blower

A new, 40 in. centrifugal blower with a capacity of 15,000 cfm has been added to the extensive line of **Industrial Plastic Fabricators, Inc.** blowers. The line now consists of units with a range of 143 to 15,000 cfm at various static pressures.

The new model (No. CB-40M) is especially suited to installations used to expel corrosive air and fumes. Metal blowers (even when coated with expensive protectives) have been found to involve costly maintenance and replacement. Model CB-40M is made of unplasticized polyvinyl chloride.

This is not a coating, but a material with which the housing and impellers are constructed. It is extremely resistant to corrosion resulting from fumes and gases.

The impeller wheel is designed with the back curve, non-overloading characteristics that maintain high efficiency for the conveyance of air and gases. Vibration is eliminated and the impellers are not subject to unbalance. Blowers are equipped with a PVC shaft seal to give long service life to the main drive shaft. Inlet and outlet flanges, gaskets and drain plug are standard PVC parts. (227)

Tubular construction

A 12 page booklet illustrating the full range of Kee Klamp pipe fittings has just been published by **D.B. Equipment and Engineering.** It gives details of several new types designed to supply 120 deg. angles and other forms often encountered in pipe construction.

The catalogue is complete with prices and dimensions of all sizes for use with black or galvanized pipe from 3/8 in. to 2 in. Kee Klamps can be used to make all kinds of pipe structure, from hand rails to storage racks and bench frameworks. Only unskilled labor is required to cut the pipe and tighten the Allen set screws in these malleable fittings. All materials are salvageable; broken or bent guard rails can be replaced in a fraction of the time required when using threaded pipe. (228)

Draft control

Automatic draft control, to provide maximum combustion efficiency of gas, oil or stoker-fired equipment, is now available in a new line of combustion instruments offered by **General Controls Co.**

These feature a new type of cast-aluminum case that permits either flush or surface mounting.

The close control of overfire draft provided by this automatic system reduces the loss of useful heat. The draft program control maintains a correct draft for all firing conditions and also ensures safe starting, by opening the uptake damper prior to burner ignition. This control simplifies installation, by providing manual switches, convenient terminal facilities and relays within a single compact unit. (229)

Cyclometer dial

For easy, accurate meter reading, the **Canadian Westinghouse Type D lifetime meters** are now available with a new cyclometer register dial. This is the first time that the larger figure dial has been available on the lifetime meter (introduced by the company last year).

A new "trip-over" action trips cylinders to eliminate half-hidden numbers. With this feature, only completed figures are shown and this helps to reduce errors and customer complaints. In addition, the easier-to-read dial aids personnel. (230)

Footswitch

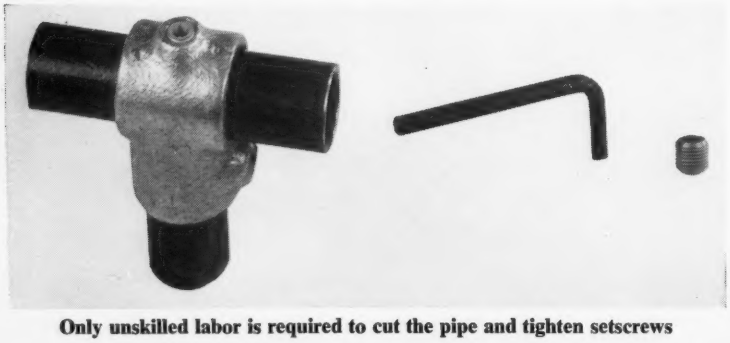
A low-cost footswitch from **Vemaline Products Co.** is attractively designed to match modern machine styling. The low height gives it a streamline appearance and also makes it easily operated either from a sitting or a standing position. This leaves the operator's hands free for greater efficiency of operation. The grooved top prevents his foot from sliding and the rubberized cork skid pad on the bottom keeps the switch in place. This component is precision built of cast aluminum with a snap-action switch interior. The switch is rated at 15 amps, 125 volts (a-c). The footswitch is available with a standard cordset or with a cordset to customer specifications. A safety guard is also available. The footswitch measures 3¾ in. x 3 in. x 1¼ in. and weighs 10 oz. (231)

Electric Actuator

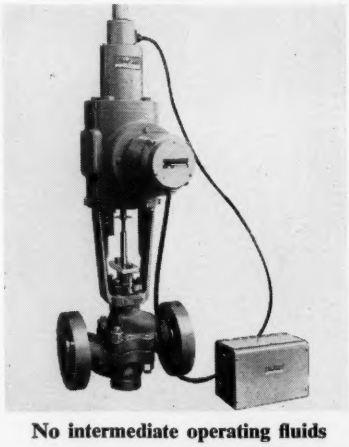
A recent development of **Conoflow Corporation** is their Series D Actuator. This is an all-electric, proportional positioning device for use in conjunction with modern electronic control systems. One important feature is that it requires no intermediate pneumatic (or hydraulic) operating fluids. The unit combines the desirable features of an all-electric system with the mechanical simplicity and ruggedness of a pneumatic actuator.

The model is suitable for immediate application on valves and other processing equipment. These include: single-seated and double-ported control valves, butterfly valves, proportioning pumps, mechanical and electrical speed controllers. It is also suitable for many complete all-electric systems, where other modes of control have not proved practical. A few of these are: automatic control involving transmission of signals over long distances (such as are encountered in tank farms and pipe line services); use in toxic atmospheres, or in areas where extremely low ambient temperatures are present.

The Series D actuator has a stroke of ¼ in. to 2 in., with a stem speed of 4 in. per min at the maximum rated output of 500 lb thrust. It is both compact and lightweight; complete assembly of motor and yoke stands only 25 in. high and weighs less than 35 lb. It can be mounted in any position and is not affected by normal vibration. (232)



Only unskilled labor is required to cut the pipe and tighten setscrews



No intermediate operating fluids

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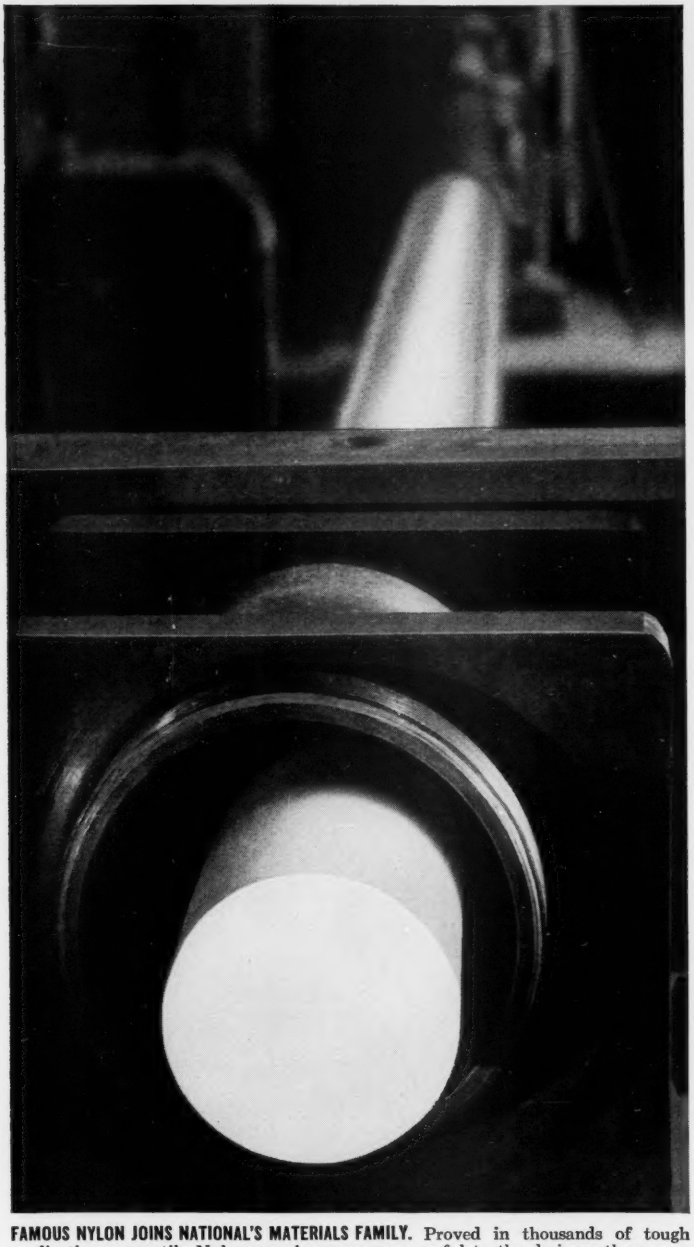

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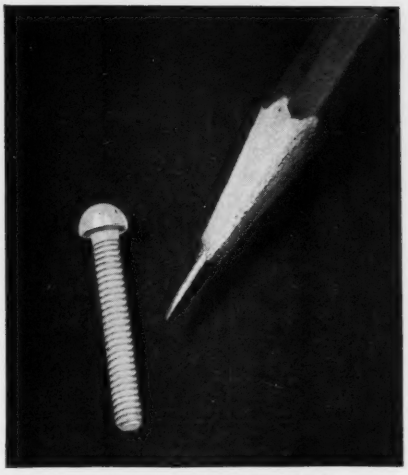

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New products
Continued

Worm gear jack

A special worm-gear jack is playing a vital role in the growth of the aluminum industry throughout the world.

The jack, used to lower carbon anodes into electrolytic pots for smelting aluminum, has been installed in aluminum reduction plants in Canada, the U. S., Norway and Germany.

These anode jacks (as they are called) are produced by **Duff-Norton Company.** They are an adaptation of the standard worm-gear jacks widely used in a number of industries to raise and lower movable parts, particularly in metalworking equipment such as threading machines, shears and rolling mills.

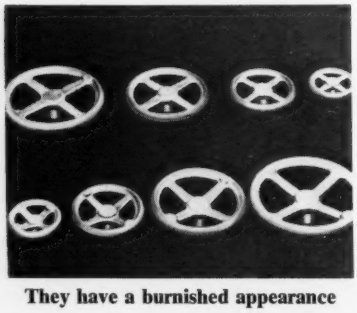
In the production of aluminum, primary metal is made in large carbon-lined steel cells (commonly called pots) in which direct current flows from carbon anodes. The latter are partially immersed in a molten solution of alumina (aluminum oxide) in cryolite.

The electric current causes metallic aluminum to be deposited at the bottom of the pot (whence it can be periodically removed) while the oxygen from the alumina combines with the carbon anodes and is released as carbon dioxide gas. This combining action gradually consumes the carbon anode.

For that reason, the anodes have to be lowered from the frame which holds them so that they are kept at the proper level in the solution. The special jacks perform this function. (233)

Hand wheels

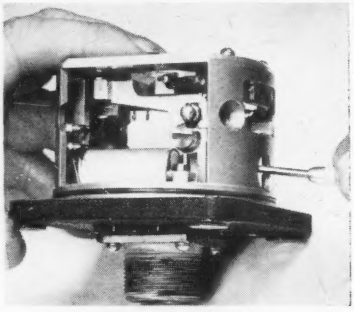
New additions to the line of straight and angular hand wheels manufactured by the **Jergens Tool Specialty Co.,** now make this one of the most complete lines available to industry. Both types of wheel are light-weight aluminum castings, plain or finished (finished off OD, faced bosses, spot-centered) with or without a lug for the revolving handle. Straight hand wheels are now available in 6 to 12 in. diameters; annular hand wheels in 4 to 14 in. diameters. Wheels from 6 to 10 in. diameter are standard four-spoke models. The burnished appearance of these wheels brightens and dresses up equipment on which they are installed. Straight and angular hand wheels are used as original equipment on machinery made by leading manufacturers. They are just as useful for special jigs and fixtures and other work holding (or moving) equipment in the shop. (234)



They have a burnished appearance

Accelerometer

An accelerometer, with caging mechanism that prevents potentiometer wear when the system is not in use and protects it from the abuse of shipping and handling, has been introduced by **Humphrey Inc.**



Accurate to 0.5%

The special caging mechanism of this new accelerometer (Series LA07-0100-1) is electrically released when the instrument is in use. The instrument offers accuracy to ½% and wide temperature range without the use of heaters.

Other significant features of the instrument are its lack of pivots, bearings or loose springs, its pressure-sealed case and its high output potentiometer pick-off.

It weighs 18 oz; case height is 2.56 in.; diameter, 3.25 in. at the top, 3.36 in. at the bottom. The operating temperature range is —50 C to +100 C, and the instrument can withstand vibration from 10 to 2,000 cps to 10 g. It is shock-resistant to 40 g (or to 100 g) (235)

High creep strength

A self-annealing tin base solder with unusually high creep strength has been announced by **Alpha Metals Inc.** It can be applied at much lower temperatures (namely 428 to 435 F) than silver solders and brazing alloys.

Known as No. 38 alloy, the solder has been successfully tested in several applications requiring high creep strength. One of them is the soldering of flanges to the barrels of wave guides. Test data indicates that, in addition to its strength, use of the material eliminates the distortion that generally results from excessive heat. It also ends low conductivity problems caused by the oxide films produced from brazing fluxes.

No. 38 is a lustrous alloy (like stainless steel in appearance) which flows and has good wetting properties. While the creep strength is less than that of silver solders, it is high enough (under usual loads) to withstand creep for an indefinite period.

The alloy, which is available in diameters of 0.032 to 0.125 in. of solid wire, may be heated by iron, resistance tools, flame or induction heating. Alpha 200L flux is recommended for use with the alloy because it becomes active and remains active during the heating cycle necessary to flow the alloy. (236)

Air filters

Completely redesigned compressed-air filters (Series 30 AE) that offer many notable advancements in air filtration are being marketed by the **C. A. Norgren Co.**

Moisture removal efficiency has been stepped up. Pressure drop has been further reduced. Hinged-type clamp rings have a chained clamp pin to simplify servicing. Newly designed louvre plates (that set an improved centrifugal air flow pattern) and larger filter elements help to produce a higher degree of filtering efficiency. (237)

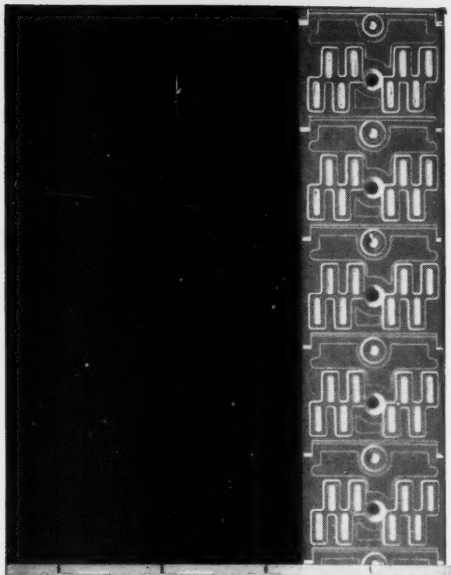
Small bore cylinders

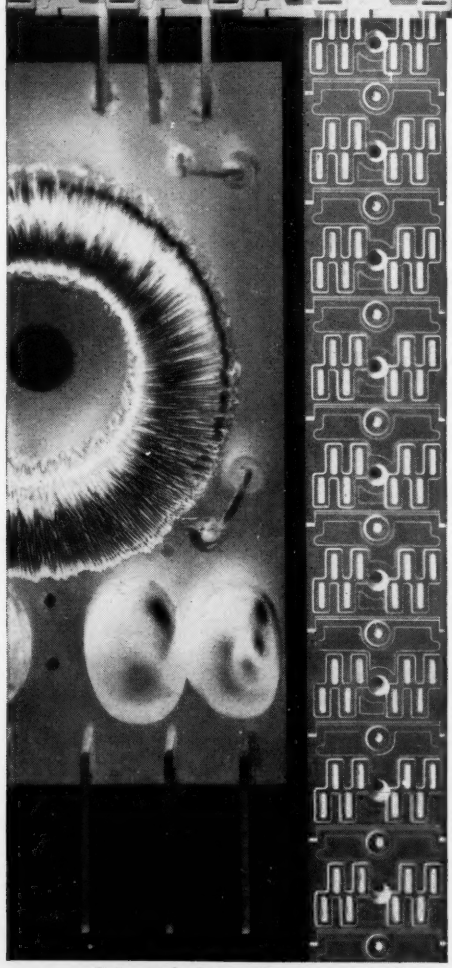
A complete line of miniature air cylinders (with bores of ⅜, ¼, ¾ and 1½ in.) for use in light production positions or new products is announced by **Airmatic Valve, Inc.** These convenient aids to automation are small but sturdy. They have ⅛ in. thick brass tube walls and are life tested for millions of trouble-free cycles of operation.

The blind ends are silver-brazed to the tube, while the front gland piston-rod-end is internally threaded, to allow for easy repairs.

They can be mounted wherever space is at a premium, and are especially useful for activating electrical contacts in test jigs and fixtures, as miniature air vices and in automatic work for feeding, ejecting, soldering, welding, brazing, stamping, bending, marking and assembly. (238)

Tiny aids to automation





THIS IS CYPAK

for more flexible industrial control

In the flexibility of CYPAK lies the challenge to throw out mechanical relay limitations and simplify control for more automated production.

For example, CYPAK systems employ just four different component panels. They provide, in the most practical form, the four basic logic functions of computer science. With infinite combinations of these panels you can direct, far more simply, a greater range of equipment operations.

Because the magnetic "make and break" of CYPAK circuits has no moving parts, it is five times faster than mechanical relays. It's the basic reason for CYPAK flexibility in handling control signals.

In addition, CYPAK systems are designed for physical flexibility. A common power channel is the backbone of each system. Into it CYPAK elements are *plugged in*, *locked in*, and signal terminals joined. In this manner, the system is easily expanded or replacements made after installation.

Look into all the new opportunities in CYPAK by calling your Westinghouse sales engineer.

Write today for your free copy of CYPAK *Industrial Control Systems*, Booklet B-6738. Canadian Westinghouse Company Limited, Industrial Control Department, Hamilton, Canada.

57 A 200

WATCH WESTINGHOUSE

WHERE BIG THINGS ARE HAPPENING TODAY!

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to 40% which occurs during the sintering process is only one of many formidable production problems to be contended with.

Rogers is now marketing over 1,000 ferrite products. They come in a broad range of shapes: slugs, rings, quadrants, U cores, E cores and others. (214)

Epoxy coating opens a new field for phenolics

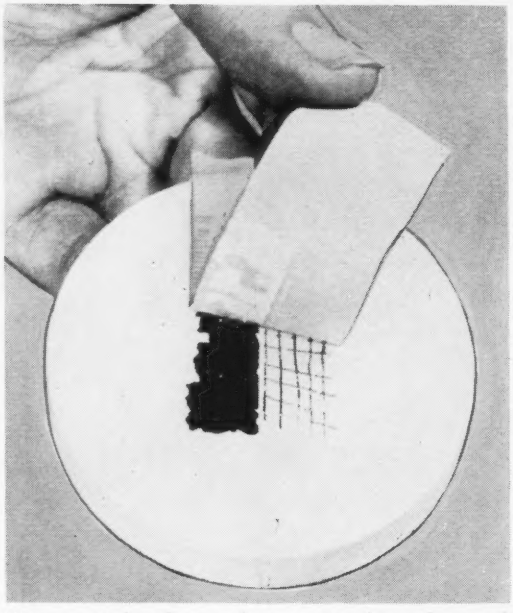
Phenolic plastics are recognized for their low cost, easy moldability, excellent dimensional stability, electrical insulating properties and resistance to heat, water and chemicals. But, until now, they could not be used when bright colors were required. Conventional coatings on phenolics were not successful and designers were therefore forced to specify one of the more costly plastic materials for their colored products.

With the new Bakelite epoxy resin coatings (manufactured by Roxalin of Canada, Ltd.) phenolic products can be coated in a single coat application with any color (even metallic) and can have any gloss from dull to high. Total material cost of the enamel, based on complete utilization, is about 1½ cents per sq ft. The coatings are non-chip, flexible and resistant to heat impact and abrasion.

This new enamel will cure by air drying, force drying or baking. Air dry pieces can be handled in about 2 hours. The fast cure eliminates production bottlenecks at the drying ovens. The possibility of curing with low heat (or none at all) opens up the field of precision parts to color. Previously, they had to be made with moulded-in color since the parts were liable to distort with conventional oven-curing of finishes.

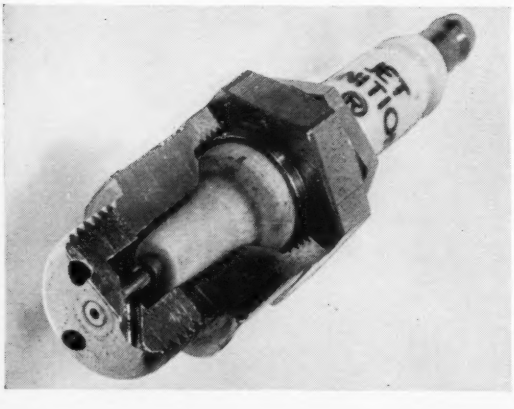
This spray-coated finish has a much superior depth of color than the built-in colors. Since it can be applied at comparable cost, the new enamel is opening up the field of moulded radio cabinets to phenolics.

Other interesting possibilities, where color demands can be met with these coatings on products moulded of economical phenolics include: vacuum cleaner parts, telephone handsets, kitchen utensil handles, wiring devices, washing machine agitators, buttons and bottle closures. (215)



Epoxy resin-based enamel stays put when others peel.

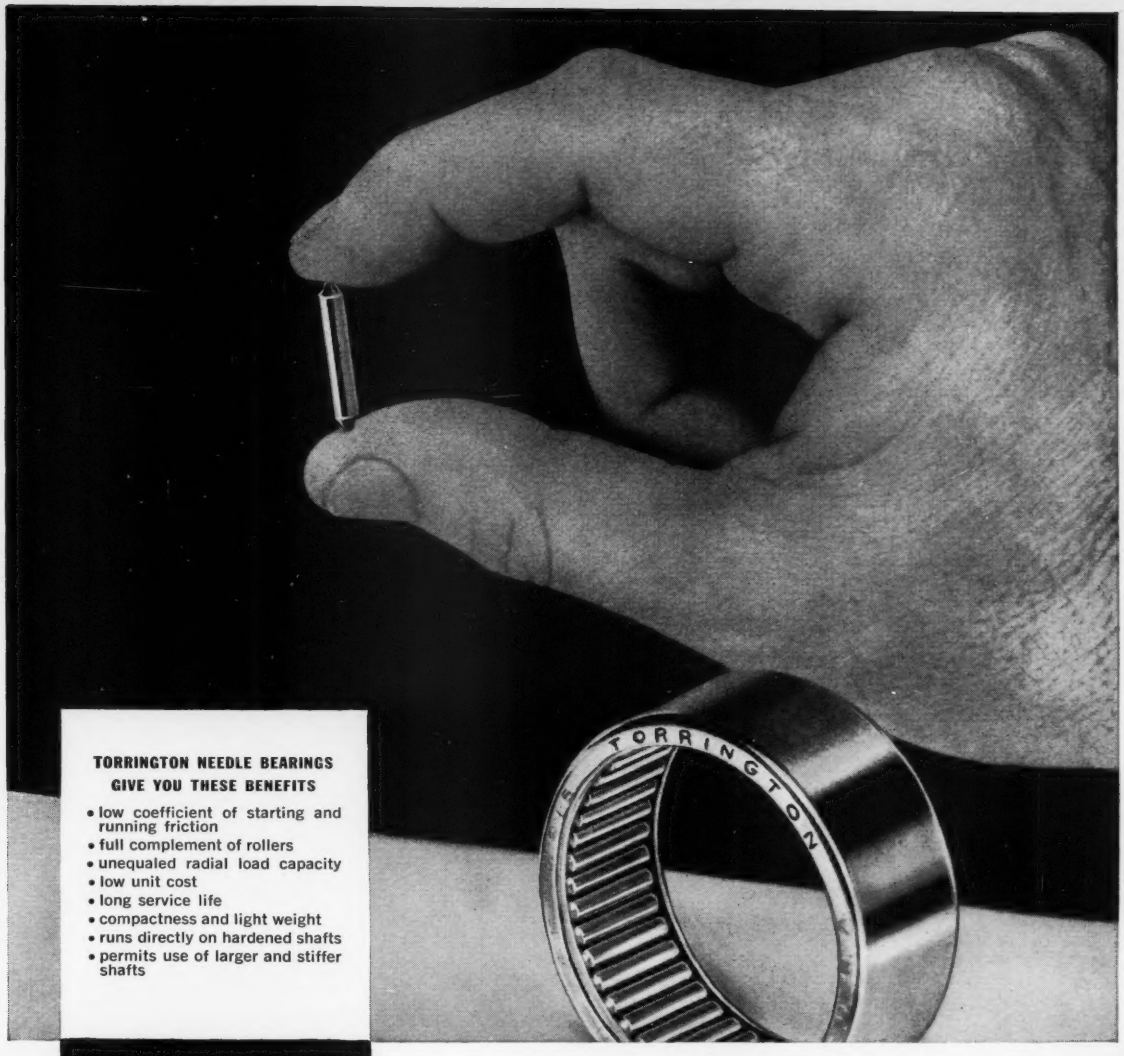
Sparkplug with a different approach



Because of its heat shield (which encloses the insulator and electrode gap) the Jet Flame Igniter is claimed to have better control of temperature, carbon and lead deposit than the conventional spark plug.

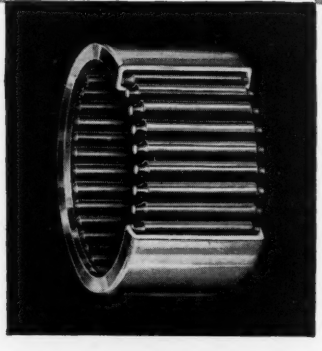
The shield has three tangentially drilled holes which provide a means of communication to the ignition chamber. These holes are located so that the minimum amount of radiant heat is permitted to pass in a straight line to the insulator and electrode, thereby considerably reducing the operating temperature of these parts and achieving, as a result, minimum electrode erosion. The heat shield also prevents the insulator from reaching temperatures that would cause breakdown of the compressed gaseous charge. This heat shield also prevents the possibility of having free hydrogen sprayed off during lean mixture operation and causing serious preignition or very erratic ignition. The ground electrode

Continued on page 80



TORRINGTON NEEDLE BEARINGS GIVE YOU THESE BENEFITS

- low coefficient of starting and running friction
- full complement of rollers
- unequaled radial load capacity
- low unit cost
- long service life
- compactness and light weight
- runs directly on hardened shafts
- permits use of larger and stiffer shafts



Close-up of precision!

This Needle Roller, key to the operation of the Torrington Needle Bearing, is a microscopically precise example of Torrington craftsmanship.

In every manufacturing step, from selection of bearing materials to final polishing, these rollers are checked with strict quality control.

A full complement of rollers, mounted in a precision-made, case-hardened retaining shell, provides a maximum number of contact lines, giving the Torrington Needle Bearing a higher radial load capacity than any other anti-friction bearing of comparable size. Rollers operate smoothly with low coefficient of starting and running friction.

Torrington's experience with Needle Bearings spans the history of their development for thousands of successful applications. In seeing that you get every last ounce of performance these unique bearings can deliver, your Torrington representative is an expert: call on him at any time. *The Torrington Company, Limited, 925 Millwood Road, Toronto 17, Ont., Canada.*

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pin (in the heat shield) is drilled to provide absolute scavenging of the spark plug.

The insulator of the Jet Flame Igniter (and the ignition chamber of the heat shield) are constantly kept clear of any deposit of foreign matter by the scouring action caused by the high velocity vortex setup by alternate pulsation of fresh and burning gases through the tangential holes of the shield. Due to the greater volume (and velocity) always coming out of the ignition chamber than there is going into it, the tangential holes and ignition chamber are automatically cleaned. The plug need not therefore be removed. (216)

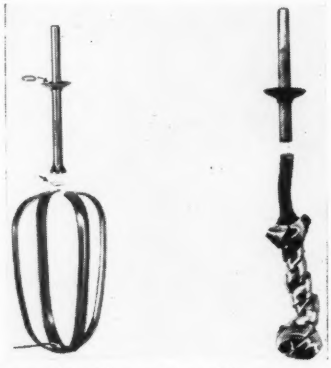
Brazing helps a housewife clean her food mixer

Cleaning the blades of a food mixer is a chore most housewives can do without. The traditional longitudinal shaft inside the blades requires some adept finger poking in order to clean the inside surfaces of the blades. Also, when these blades are joined in the standard manner (usually by riveting) food particles and moisture can seep into joint crevices from which it is difficult to remove them.

The brazed mixer blade that Hunter Spring Co. developed for the GE food mixer, eliminates all these problems. They discarded the central stem and get the required joint support by brazing the blades at two points. The filler metal fills and seals these joints, and so does away with potential food and moisture traps.

The mixer blade is fabricated in two steps. First, the joint at the base of the blades is made by placing a small shim of Easy-Flo silver alloy, filler metal on top of the joint and brazing with a spot welder. Then these assemblies are placed (six at a time) in a jig. The drive shaft is positioned on the upper joint, with another square of filler metal placed between the shaft and blades. At the same time, a small ring of filler metal is placed in the dough guard near the upper end of the stem. These 12 joints are made in one pass by an induction welder.

When these mixer blades are torsion-tested to destruction, the shaft fractures but the joints hold, in the manner shown below. (217)



Housewife with a yen to whip up a nut and bolt soufflé can rest assured that mixer shaft will break before blades separate.

Putting a big squeeze on spongy titanium

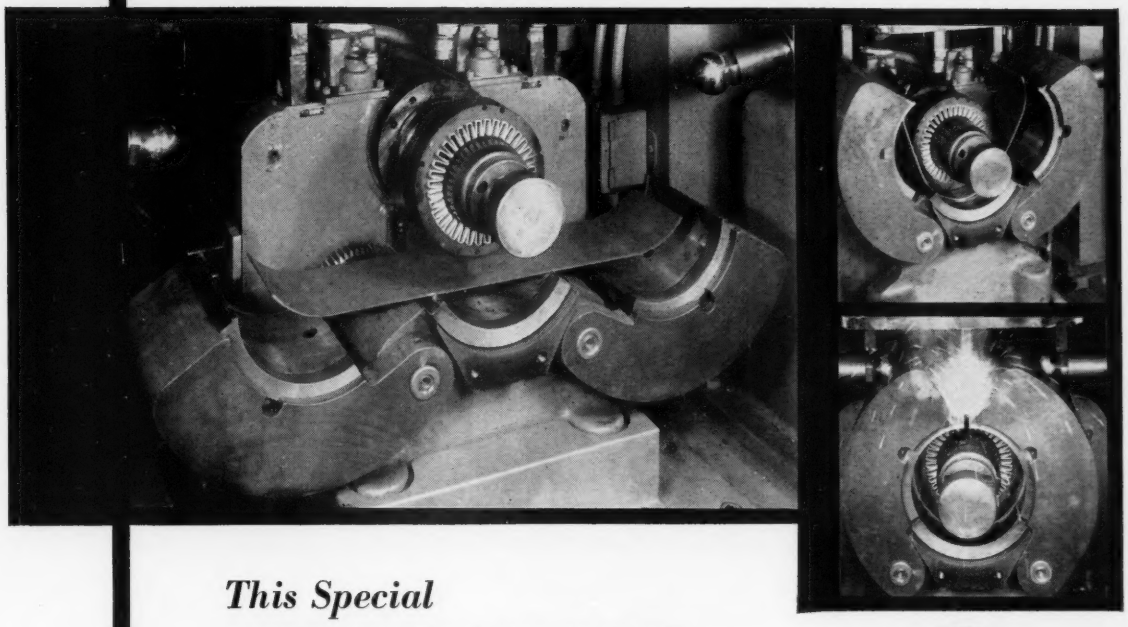
The availability of titanium depends not so much on the supply of raw material as on the development of manufacturing techniques. Present techniques are in constant flux, as new refining and processing methods are unveiled almost daily.

Getting the titanium ore is no great problem, for the element is in abundance. Getting the ore from the mineral stage (by chemical processing) is relatively simple too. The problems start when the metal reaches the sponge stage. In this initial form it is a springy, porous mass of small bulbous particles.

The loose sponge must be compressed into bars which are then joined together to form consumable electrodes. These electrodes are afterwards melted

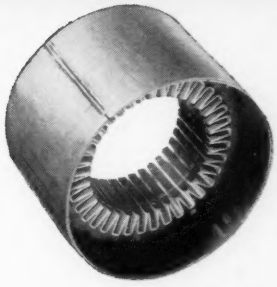
Continued on page 82

Another Special by **STANDARD–MODERN**



This Special
AUTOMATIC WELDER

precision forms and welds stator core assemblies in 36 seconds*



The time-consuming process of wrapping stator cores for fractional horsepower electric motors is reduced to a swift, precision job by this Standard-Modern Automatic Welder.

The operator simply places a strip of flat steel stock with preformed ends under the wound stator core, which is held on a central spigot, and presses the cycle start buttons.

Steel jaws wrap and clamp the strip around the core, leaving a gap of about 1/32 inch. With an inert gas shield and wire filler, the gap is then welded automatically. Shrinkage of the weld permanently binds core and shell together. The forming jaws then automatically release the completed assembly for removal.

A formerly slow and troublesome hand operation is accomplished—accurately and uniformly—in 36 seconds, a fraction of the time formerly taken.

*Average floor to floor time.

STANDARD-MODERN Special Machines are speeding production, saving time and money for industry across Canada.

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TOOL COMPANY LIMITED
MANUFACTURING DIVISION

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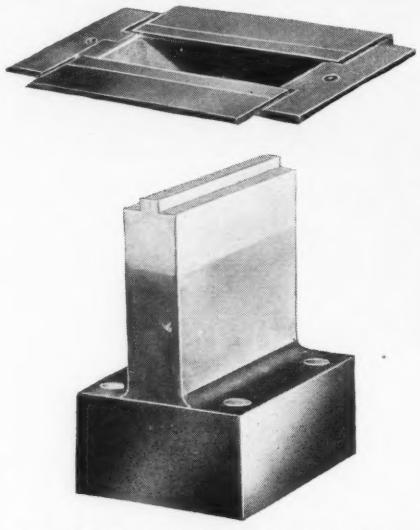
• SP-3 •

into titanium ingots in a special consumable-electrode vacuum arc melting furnace. Such a furnace is necessary because of the metal's great affinity for many other elements.

The Physical Metallurgy Division of the Department of Mines and Technical Surveys is engaged in extensive experiments on titanium. Recently, experiments in consumable electrode vacuum arc melting led to the development of a production die to compress the sponge into rectangular bars about 2 in. x 8 in. x 8 in. Diemakers Limited (of Montreal) built a die that would produce a rectangular compact bar of the special shape required. The die, designed by B. A. Berger, consulting engineer, is operating most successfully.

Great care had to be observed in selecting the tool steels for the die, because they have to stand up to the 30 or 40 tons per sq in. pressure exerted on the titanium sponge to achieve the required 75% density. Yet another factor that had to be contended with was the inherent tendency of titanium to cold-weld to any other metal surfaces it comes in contact with under pressure. This causes galling on the die liners.

Two grades of Atlas steel were chosen for this composite die. For ability to withstand severe abrasion (and the galling action of titanium) combined with high strength, Atlas Nitralloy (heat treated and ground to Rockwell C 54/55) was used for both die liners and for the 3 in. front portion of the die punch. Back up plates on die and punch were made of SPS-245, heat-treated and ground to Rockwell C 52/54. The die liners and backing plates are set into a 4 in. thick mild steel frame on top of a 4 in. mild steel base plate.



Nitralloy was used for both the die liners and the 3 in. front portion of the punch.

The finished die (with overall dimensions of 8 in. high, 24 in. wide and 36 in. long) is used on a press that operates at 500 tons. (218)

Valve to take the "creep" from hydraulic systems

Creeping of the loaded cylinder because of seepage (a common fault of many hydraulic systems) is prevented by a new lock valve developed by the Webster Electric Company.

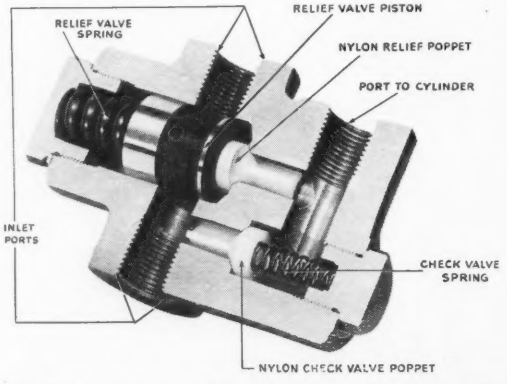
The purpose of this WV lock valve (which can be applied virtually to any hydraulic lift system) is to supplement the seal on a standard directional valve, in order to provide a positive lock of the cylinder until the flow is deliberately reversed. Thus, an implement on a tractor, for example, is held firmly in position with no slippage, until it is released by operating the directional valve.

The valve has almost limitless applications for hydraulic cylinder lifting devices, such as farm tractors, road-building equipment, lift trucks and mechanisms, and factory and machine tool apparatus. The valve can handle up to 20 gpm and will operate satisfactorily up to 1,500 psi.

It has two valves, check and relief. Poppets on the check valve (which is held in position by a light spring) and on the relief valve are constructed of nylon.

The valve is provided with two inlet ports. The one that is not used can either be plugged or used as a pressure gauge port. The lock valve can be located in the line supplying either the head-end or the rod-end.

Construction of this lock valve is such that it offers minimum restrictions when operating the check valve;



The lock valve provides a positive seal of the cylinder to prevent seepage which causes a hydraulic lift system to slip. It operates up to 1,500 psi in safety.

it requires approximately 1,200 psi before reverse flow is started. Once reverse flow is started, the return pressure drops to about 150 psi, because of the large piston.

This feature is incorporated so that it will not require 1,200 psi during the entire stroke to perform this operation. (219)

Continued on page 92

Plant engineers—here's two minutes *necessary* reading

G-E VOLTAGE STABILIZING TRANSFORMERS

TAKE THE LOSSES OUT OF YOUR PRODUCTION CYCLE

When you translate improper operation or equipment failure into terms of downtime and dollars lost, you come up with some very good reasons for stabilizing voltage. Conditions between source and load can cause voltage to vary as much as ten to fifteen percent. And in an automatic production cycle, varying voltage at the load seriously affects the operation of sensitive equipment. Thus, fluctuating voltage can cause improper operation of equipment or equipment failure.

Economical Voltage Stabilization

For most applications, voltage stabilizing transformers provide the most economical way to stabilize voltage at the load. The Canadian General Electric manufactures a complete line of these voltage stabilizing transformers which absorb the ups and downs of input voltage, and deliver stabilized output voltage to the load. Standard G-E voltage stabilizing transformers connected to an ordinary power-supply line can stabilize up to a 30% change of voltage to plus or minus 1% within 1½ cycles.

Automatic Voltage Stabilization

Stabilizing voltage with G-E voltage stabilizing transformers is completely automatic—no dials to set—no moving parts; no relays or tubes to cause maintenance problems. Simply connect the right G-E voltage stabilizing transformer on the line, and as the input varies, the output is held steady. Other features of these G-E voltage stabilizing transformers include: smaller size, reduced weight, primary-secondary isolation, built-in voltage transformation, rapid response low stray-field intensity, wide input voltage range.

Before You Invest in Stabilizing Equipment

Unquestionably there are many ways to stabilize voltage. The type of stabilizing device that should be employed, of course, is the one that will provide the most economical stabilization to a satisfactory degree. That's why before you make *any* investment in more expensive voltage stabilizing equipment, make certain you investigate General Electric voltage stabilizing transformers by contacting your local distributor or nearest General Electric Wholesale Office. Or send for a special bulletin on G-E voltage stabilizing transformers by mailing the coupon below. Canadian General Electric Company, Ltd., Toronto 4, Ontario.

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CANADIAN GENERAL ELECTRIC COMPANY LIMITED

P & B STRIKE SETTLED!

AN OPEN LETTER TO RELAY USERS

Potter & Brumfield, inc.

Dear Friends:

Ruthless violence, culminating on February 13 with the shooting of the four-month-old baby daughter of two of our employees, focused national attention on a recent strike at our Princeton, Indiana plant.

This unjustified strike was called on November 5, 1956 in the face of our "no strike" contract with Local 1459 of the International Association of Machinists. No demands or proposals for settling the strike were made by the Union. Two Company proposals were summarily rejected.

Settlement of the strike was reached on February 28, 1957.

Our plants in Laconia, New Hampshire and Franklin, Kentucky were not affected by the strike.

Production lines were shifted from Princeton to both Laconia and Franklin plants, and employment has been greatly increased at both locations. These plans were made before the work stoppage to increase production.

Production at Princeton was resumed on December 17th, and today a normal work force is manning the remaining lines. Until recently, the training of new workers restricted our productivity, but output now is at satisfactory levels.

With three plants to serve you, we pledge our continued efforts to provide you with relays of the finest quality. Our Engineering Department welcomes the opportunity to work with you on new designs and future projects.

Sincerely,

Dale V. Cropsey

Dale V. Cropsey
Vice President & Director of Sales

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3 PLANTS TO SERVE YOU

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POTTER & BRUMFIELD, INC.

PRINCETON, INDIANA A Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY

Pressure measurement

(continued from page 55)

iron core between two electro-magnets of the error detector. The coils of the two magnets are branches of an inductivity bridge, which is adjusted for balance when the capsule is in zero position. Any deflection of the capsule will alter the air gaps (and therefore the inductances) of the two coils and will provide a phase-sensitive error signal. This error signal (after sufficient amplification) drives a servo motor, which applies torsion to a torsion bar.

This arrangement constitutes a normal, closed-loop servo system. It can be seen that the servo motor will twist the torsion bar until the diaphragm is restored to its original position. The deflection of the torsion bar can be calibrated in terms of pressure.

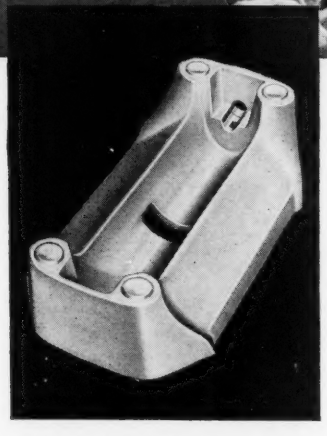
The Pressure Sensor

As discussed before, a flexible capsule is required which deforms under the influence of pressure and can be restored by an external force to its original volume. Fig 4 shows a suitable design. The capsule is sufficiently stiff not to deform under pressure and is closed by a centrally stiffened diaphragm. It is flexible only around a narrow ring close to the edge. Deflection of a diaphragm like this under a distributed (or concentrated) load has been treated mathematically by various authors. Accordingly, deflections are proportional to load, provided that the deflections are small in comparison with the thickness of the flexible edge. This flexible edge would be easily damaged if subjected to pressures of a magnitude likely to cause larger deflections.

For practical design it is therefore necessary to provide solid stops in order to prevent these excessive deflections. Furthermore, great care has to be taken in clamping the flexible ring to the stiff parts of the capsule. Friction is insufficient and strong sections have to be attached to the edges of the flexible ring as positive interlocking fits. The various parts are dimensioned in such a way as to introduce radial stress in the flexible ring, or else an uncertain position would result for the condition of no-pressure-difference-at-all. Lid and capsule (as well as the two parts of the stiffened centre portion) are tightly screwed together. The screws are not shown. The position restoring force acts on the centre of the diaphragm. Deflections are strictly linear for small pressure differences and of approximately half the magnitude, as on a conventional capsule for the same pressure range (see Fig 5, for the results of actual measurements).

(continued on page 86)

How C.S.I. "clean casting" methods produce better wringers for Connor washing machines—and cut production costs!



Wringer frame for the Connor washing machine, sand cast in aluminum alloy by Canadian Steel Improvement Limited.

When J. H. Connor & Son Limited, Hull, Quebec, makers of famous Connor washing machines, asked Canadian Steel Improvement Limited to cast their wringer frames, they obtained a better part at a lower unit cost.

Here's why: C.S.I. "clean casting" methods mean parts that are
free from internal defects
held to close, accurate dimensions
extremely smooth surfaced.

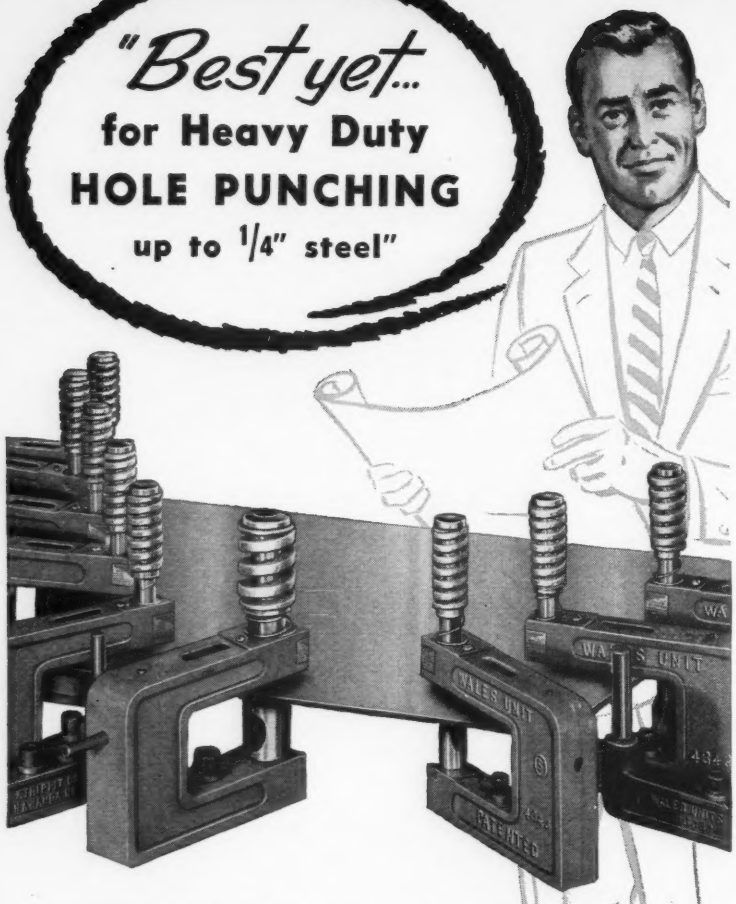
The high quality of C.S.I. castings gives greater control over the alignment of roller bushings, reduces machining operations, and the smooth surfaces take a high gloss finish with minimum preparation. Starting from the competitive initial cost of these ideal wringer frame castings from Canadian Steel Improvement Limited, the manufacturer cuts assembly costs right down the line.

If You Have a Casting Problem, Call C.S.I.

C.S.I. "clean-casting" methods apply to sand castings in Aluminum and Magnesium and to Permanent Mould and Pressure Die Castings in Aluminum.

CSI **CANADIAN STEEL IMPROVEMENT LIMITED**

"Best yet... for Heavy Duty HOLE PUNCHING up to 1/4" steel"



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WALES CJ Units punch unlimited straight line staggered and scattered patterns . . . round or shaped holes. Die retention design features rapid die change WITHOUT REMOVING UNIT from set-up . . . provides controlled slug ejection. Time saving and money saving. Same units may be used over and over again in other patterns.

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Shows actual job work and complete data of CJ sizes.

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WALES-STRIPPIT COMPANY, AKRON, NEW YORK

Pressure measurement

(continued from page 84)

Fig 6 shows a conventional capsule and a centre stiffened diaphragm: (a) undeflected, (b) deflected by an internal overpressure and (c) finally in force balance.

Both the flexible and the centre stiffened capsule deflect under the influence of internal overpressure as indicated in Fig 6 (b). The deflection of the centre stiffened unit is naturally much smaller, approximately half the deflection of the normal flexible one, as the deflection is limited to the lid only. Fig 6(c) shows both units restored to the original centre distance h and H respectively by a force applied to the centre. The force f required to restore the elastic capsule is much smaller than the product of capsule area and pressure difference. This can be shown mathematically for the simplified problem of a thin circular plate with clamped edges for a distributed load and for a load concentrated at the centre.

The deflection of a plate (in accordance with Fig 7(b)) with distributed load p is:

$$\Delta = \frac{pa^4}{64\ D}$$

The quantity D (called the flexural rigidity of the plate) is defined by the thickness and the material of the plate.

For a plate with a concentrated load P (in accordance with Fig. 7(c)) the deflection at the middle is:

$$\delta = \frac{Pa^2}{16\pi D}$$

The solution of the statically indeterminate problem of Fig 7(a) can be obtained by using the method of superposition.

For $\Delta = \delta$ we obtain:

$$\frac{pa^4}{64D} = \frac{Pa^2}{16\pi D} \text{ or } P = \tfrac{1}{4}\pi a^2 p$$

The total force exerted by the distributed load p over the area πa^2 is $F = pa^2\pi$. It can be seen therefore that $P = \frac{1}{4}F$

The force F on the centre-stiffened diaphragm of Fig 6 comprises at least the total of the distributed forces over the area of the stiff centre. A certain small deformation or volume change of the flexible ring will occur, but the elastic forces introduced this way will be only a small fraction of the total load.

The centre stiffened diaphragm is therefore suitable to fulfill our required design principle of separating measuring and capsule elasticity.

(continued opposite)

Pressure measurement

(continued from previous page)

Measuring Elasticity

Fig 3 showed a torsion bar as the force measuring elastic member of a system. While any other shape or type of spring (such as a coil spring) would be suitable, it appears that a torsion bar best fulfills the requirements for linearity and compactness. Coil springs which are linear over a large range are difficult to obtain, because expansion (or contraction) of such a spring usually alters the effective spring diameter as well. Coil springs for measuring purposes are therefore long and heavy.

When the deflection of a torsion bar is used for measuring purposes, a high deflection angle is desirable.

The deflection angle ϕ for a circular shaft is:—

$$\phi = \frac{2\,\tau\,\max\,l}{Gd}$$

Here, τmax is the maximum permissible shear stress, l the length of the shaft, d the diameter of the shaft and G the Shear Modulus.

The material must be selected so as to obtain minimum temperature range. The value of the modulus G and the permissible shearing stress τmax cannot be altered once the material has been selected, but the dimension l (the length of the bar) must be chosen as large as possible and the diameter d as small as possible.

Material selection is most important, as discussed before. Most suitable in every respect are certain iron-nickel alloys of constant modulus.

The error detector

The accuracy of diaphragm position defines the accuracy of the system. The position-error detector therefore must be both sensitive and accurate. An inductance bridge (fig. 3) meets both requirements, if the necessary precautions are taken to obtain electrical and mechanical stability.

Mechanical stability can be achieved by eliminating all bearings on the diaphragm torsion bar assembly and using elastic ligaments instead. Needless to say, great care has to be taken in the selection of all materials used, so as to avoid temperature effects.

Temperature effects are also a source of electrical instability. A practical design will therefore place all four branches of the inductance bridge as close together in space as possible so that all the coils are at the same temperature. By taking all these precautions it becomes possible to control the system so well that the servo motor starts with a displacement of 0.00002 in. or less. ★

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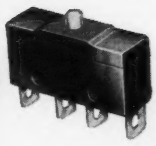
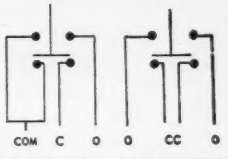


ACTUAL SIZE

CIRCUIT ARRANGEMENTS



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The electrical rating of this precision Acro Snap-Action Switch—10 amperes at 125 or 250 volts A.C. or 28 volts D.C.—is over four times that of most switches this size. It will operate within a temperature range of from +350° to −80°F., and its terminal arrangement permits wiring double circuits.

Switching mechanism is enclosed in a durable plastic case which can also be adapted to various types of present actuators and mountings not shown.

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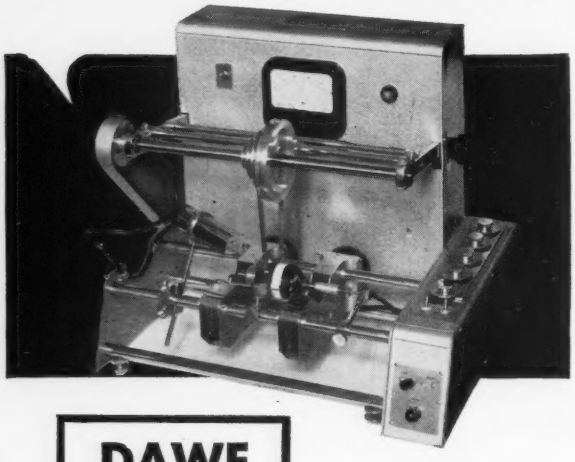

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The DAWE Dynamic Balancing Machine Type 1250, is an apparatus for quickly and accurately locating and measuring the unbalance in small rotating parts or assemblies weighing up to 10 pounds. This easy-to-use precision instrument not only shows the out-of-balance point, but also indicates the amount of correction needed.

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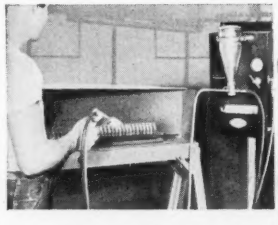
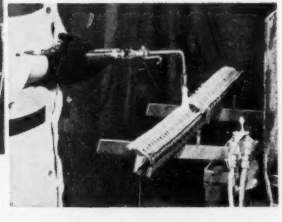
Colmonoy Spraywelding INCREASES Rocker Arm Life

Colmonoy No. 6 hard-facing alloy stopped the excessive metal-to-metal wear between the rocker arms shown and the cast iron cam shafts that operate them. Wear resistant Colmonoy No. 6 is sprayed on with the Colmonoy Spraywelder and fused in with an oxy-acetylene torch.



Rocker arms being sprayed with the Spraywelder.



After spraying, the overlay is fused to the base metal.

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Letters

Readers' viewpoints . . .

Design Engineering Index

On our subscription for DESIGN ENGINEERING this Library has received Volumes 1 and 2 which we are anxious to bind but we note we do not have an index for either volume. If indexes are available for these volumes we shall be very grateful if you will supply them immediately. However, if no indexes have been published, please advise us so that we may annotate our records and also proceed with the binding.

from (Miss) Dorothy V. McManis, Bibliographic Analyst, The Library, U. S. Navy Electronics Laboratory, San Diego 52, California.

(We wrote to explain that no index was published for Volume 1 (1955) but that the index for Volume 2 (1956) appeared on page 84 of the December, 1956 issue.

• • •

We have Design Engineering, Vol. 2, 1956 ready for binding and find that we are lacking the Index to this volume. Would you please send this Index so that we may complete the binding.

We would also appreciate it if you would put us on your mailing list for future indexes.

from, Eleanor E. A. Boby, Periodicals Division, The University of New Brunswick, Fredericton, N.B.

(In our reply, we explained that the index for Volume 2 appeared on page 84 of the December, 1956 issue—Ed.)

Liquid sealant

On page 60 of the February issue of Design Engineering a plastic sealant (by the name of Loctite) is described. Would you please send us the name and address of the supplier of this material?

from, J. A. H. Carson, Pacific Naval Laboratory, Esquimalt, B.C.

(The address is: J. S. Parker & Co. Ltd., 220 St. Paul St., West, Montreal—Ed.)

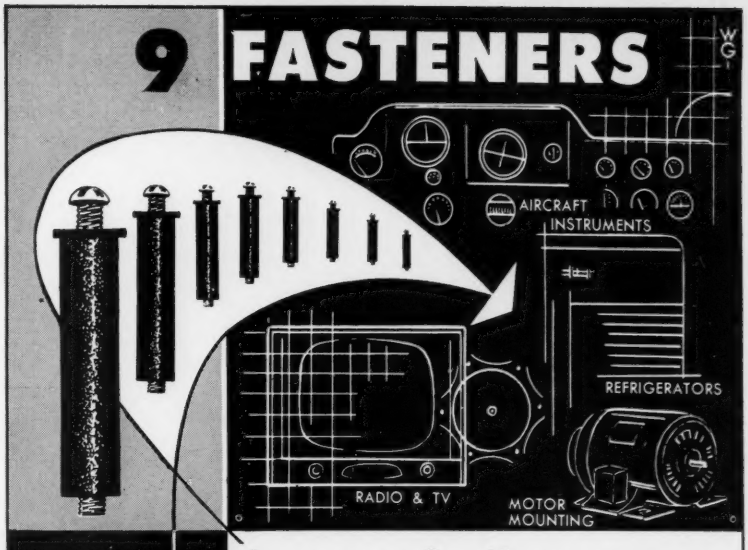
Engine preheater

I read in the February issue in the "New Products" section, Article No. 222 about the zero-start External Tank Type Engine preheater for automobiles made by Phillips Manufacturing Co.

Would you please send me more information about it, such as the price, where I may get one and technical information about it.

from Henry M. Ichiyen, 184 Domville Street, Croydon, Quebec.

(The address is: Dept. KP, Phillips Manufacturing Co. Inc., 2816 Aldrich Ave. South, Minneapolis 8, Minnesota.—Ed.)



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They're Rawlnuts*. Briefly, a Rawlnut* is a tough rubber sleeve with a tapped metal nut bonded inside. Insert it into whatever material you want to fasten anything to (or against—we won't quibble.) When you tighten the screw, the rubber is drawn up into a rivet-shaped head at the back of your base material.

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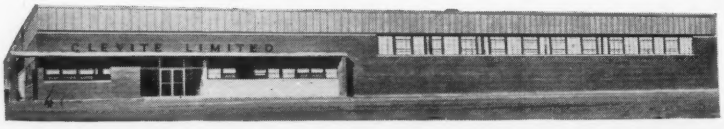

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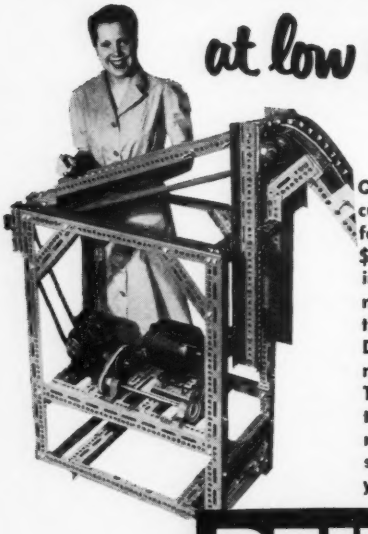

Quotations for a custom-built can-top feeder ranged up to $2000, so an ingenious plant manager built this one of Dexion for a mere $50! Think how much time, labour and money Dexion could save you in your plant.

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THERMOSTAT BOSSES SIZABLE ELECTRICAL LOADS WITHOUT RELAYS.

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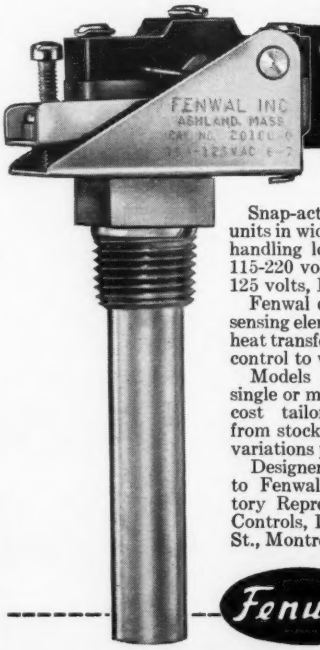

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Society Column

The Society of the Plastics Industry (Canada) Inc.
The 15th annual conference of the Society is to be held at the Chateau Laurier Hotel, Ottawa, on April 4 and 5. It will bring together about 250 leaders of the Canadian plastics industry and representatives from the United States, England and Germany. There will be a display of plastics exhibits.

Institution of Mechanical Engineers
A conference is planned in London (England) for April 30, May 1 and 2 on the properties of materials at high rates of strain. About 20 papers by recognized authorities in Great Britain, the U. S. and elsewhere will be presented in five groups under the following headings: experimental techniques; metal working; impulse loading and stress waves; nonmetallic materials; and basic properties.

International Institute of Welding
The annual assembly will be held in Essen, Germany, from July 1 to 6. The official Canadian delegates (appointed by the Canadian Council of the Institute) are R. A. Dunn, general sales manager, Canadian Liquid Air Co. Ltd.; R. M. Gooderham, director, Canadian Welding Bureau; H. Thomasson, manager, metallurgical-mechanical section, Canadian Westinghouse Co. Ltd.

It is understood that other Canadian engineers will be attending the assembly. Anyone who desires further information should write to the secretary of the Canadian Council at 7 Pleasant Blvd., Toronto.

American Welding Society
The fifth Welding Show will be held at Convention Hall, Philadelphia, on April 9-11. The exhibits will demonstrate every type of welding equipment and accessories under simulated factory conditions. About 2,500 separate items will be shown. Attendance is expected to exceed 10,000.

Industrial Designers' Institute
A distinguished group has been named by the Institute to evaluate submissions for the seventh annual IDI Design Award. They will meet on May 17 in Chicago to select from one to three industrial designers to be honored this year for their noteworthy and fresh approach to the design of products distributed on a national basis.

Society for Nondestructive Testing, Inc.
The second International Conference on nondestructive testing will be held in Chicago this fall. Details will be given in a later issue of Design Engineering.

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New rugged terminals permit easy soldering of connections without harming the transistor.

New welded case—hermetically sealed for superior ruggedness and durability.

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A COMPLETE LINE OF POWER TRANSISTORS TO MEET YOUR SPECIFIC NEEDS.

	H5	H6	H7
Input Resistance	24-48 ohms	27-54 ohms	30-60 ohms
Power Conductance	17.5-35 mhos	35-71 mhos	71-141 mhos
Current Gain, Median	30	40	60

(for collector current of 2 amps.)

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Please send data sheet TR-14 on Honeywell Weld-Seal Power Transistor.

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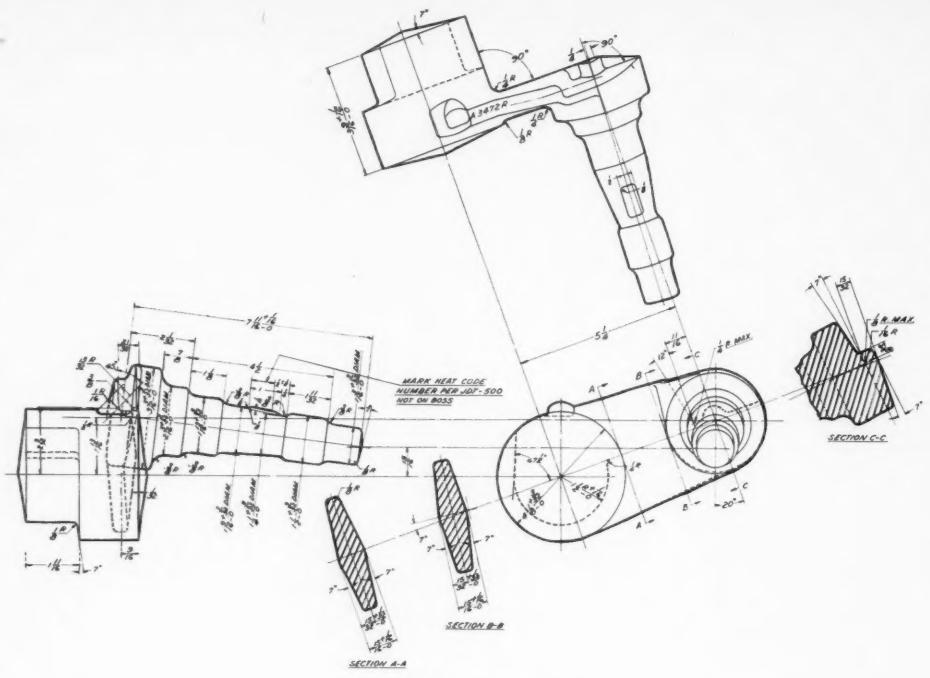


Front wheel knuckle forging

A gear segment is machined at the upper end with the lower end acting as spindle for the wheel.

Forging for a 15 lb. front-wheel knuckle

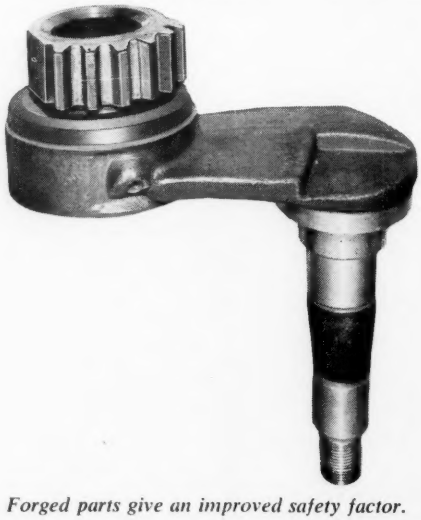
The power-steering system used on three new tractors makes steering over rough ground with heavy loads as easy as driving a car with power-steering. When the driver turns the wheel, the motion displaces a steering valve spool, causing oil to be metered to a vane-type motor for the desired degree of turn. The motor is connected directly to the steering spindle.

Front wheel loading is equalized by a construction known as Roll-O-Matic. Upward motion of either wheel over an obstacle forces the other down to share the load.

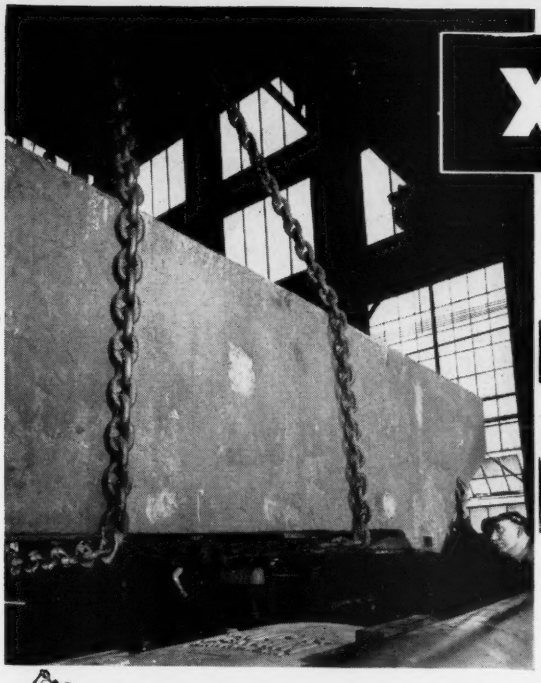
Each front wheel knuckle is a forging, 15 in. long and weighing 15 lb, made from AISI C-1045 steel. A gear segment is machined at the upper end, with the lower end acting as a spindle for the wheel. It is claimed that the part will withstand full static and impact loads under any service conditions.

Product advantages obtained by using forged parts include: greater part strength, better physical properties and an improved factor of safety. As the manufacturer puts it, forging provides a component that will give lasting service.

The photograph appearing at the right clearly shows the gear segment which is machined onto the upper end of the knuckle forging.



Forged parts give an improved safety factor.



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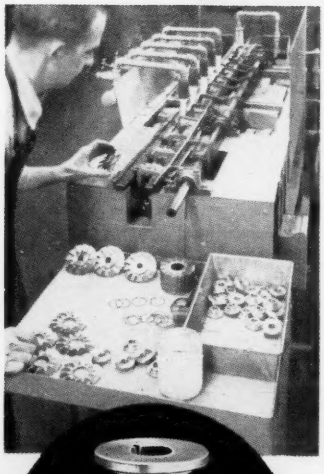

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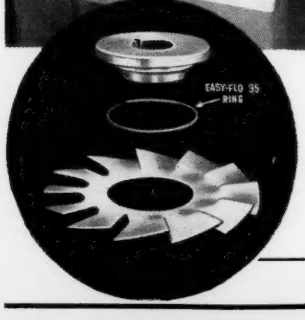
HERE IS A FINE EXAMPLE

The fans for portable drills, illustrated below, are made by brazing steel hubs into stamped steel blades on the set-up shown. Parts are degreased and assembled with a ring of EASY-FLO-35 dipped in HANDY FLUX and preplaced between hub and blade. Mechanism moves assemblies along under burners. An assembly is completed every 6 seconds. One operator does it all!



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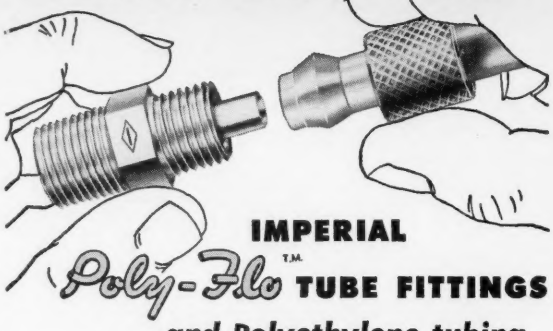
Costs far less to install!



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and Polyethylene tubing

Poly-Flo fittings and tubing furnished in 1/4, 5/16, 3/8 and 1/2" O.D. sizes. Recommended for working pressures from 75 to 160 psi. Temperatures from —90° to +175° F.

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Fittings need only be finger tightened . . . tubing bends by hand — that's why it's easy to design *huge savings* into installations previously made with copper or other tubing. Poly-Flo fittings used with polyethylene or other plastic tubing end complicated assembly, tube bending, flaring and cutting. No wrench work required!

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Accessories include tube racks for mounting of tubing, quick-disconnect and other shut-off valves, plus convenient make-up kits of tubing and fittings.

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IMPERIAL Industry's Most Complete Line of Tube Fittings and Tubing Tools

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SEALMASTER Ball Bearing Units are the answer to industry's quest for high speed and precision in production. In daily operation throughout the industrial field, SEALMASTER Bearing Units keep production on the move, reduce maintenance and "down-time" and give their users carefree bearing service.

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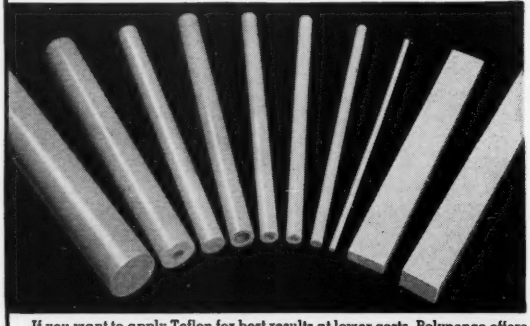

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Advertising index — April

101 Acro Manufacturing Co. 87
102 Aluminum Co. of Canada Ltd. ..... IFC
103 Anaconda American Brass Ltd. 22
104 Avro Aircraft Limited 7

105 Bakelite, Div. of Union Carbide Canada Ltd. 27
106 Blood Bros. Machine Division 25
107 B.S.A. Tools Ltd. 14
108 Burndy Canada Ltd. 42

109 Canada Illinois Tools Ltd. 30
110 Canada Iron Foundries Ltd. 13
111 Canada Iron Foundries Ltd. 28, 29
112 Canadian Acme Screw & Gear Ltd. 40
113 Canadian Allis Chalmers Ltd. 24
114 Canadian General Electric Co. 83
115 Canadian Kodak Co. Ltd. 72
116 Canadian Steel Improvement Ltd. 85
117 Canadian Westinghouse Ltd. 77
118 Clapp & Poliak Inc. 35
119 Clevite Ltd. 90
120 Crystal Glass & Plastics Ltd. 12

121 Dawe Instruments Limited 88
122 Dexion (Canada) Ltd. 90
123 Dominion Chain Company Ltd. 93
124 Dominion Magnesium Limited 21
125 Du Pont Co. of Canada (1956) Ltd. 17, 18
126 Du Pont Co. of Canada (1956) Ltd. 41

127 Fenwal Inc. 90
128 Frontier Bronze & Aluminum Castings Ltd. 70

129 Garlock Packing Co. of Canada Ltd. 71

130 Hamilton Gear & Machine Co. 37
131 Handy & Harman of Canada Ltd. 93
132 Heim Company 10
133 Hilliard Corp., The 95
134 Honeywell Controls Co. Ltd. (Micro Switch) 91

135 Imperial Brass Mfg. Co. 94
136 International Nickel Co. of Canada Ltd. 34
137 International Nickel Co. of Canada Ltd. 46

138 Jenkins Bros. Ltd. 39

139 Linde Air Products, Div. Union Carbide Canada Ltd. 16
140 Lyman Tube & Bearings Ltd. 32

141 Monsanto Canada Ltd. 11

142 National Fibre Co. of Canada Ltd. 75
143 Noranda Copper & Brass Ltd. 38
144 North American Cyanamid Co. Ltd. 15

145 Orenda Engines Ltd. 2

146 Parker Rust Proof Co. of Canada Ltd. 36
147 Polymer Corp. Ltd. 4
148 Polypenco Inc. 94
149 Potter & Brumfield Inc. 84

150 Rawlplug Products (Canada) Ltd. 89
151 Reichhold Chemicals (Canada) Ltd. 33

152 Saginaw Steering Gear Corp., Div. General Motors Corp. 23
153 Shawinigan Chemicals Limited 31
154 Shell Oil Co. of Canada Ltd. 8, 9
155 Simmons Fastener Corp. 94
156 Standard-Modern Tool Co. Ltd. (Mfg. Div.) 81
157 Steel Company of Canada, The 19
158 Stephens-Adamson Mfg. Co. 94

159 Timken Roller Bearing Co. ..... OBC
160 Torrington Mfg. Co. of Canada Ltd. 44
161 Torrington Company 79

162 United Steel Corp. 26
163 Union Carbide Canada Ltd. ..... IBC

164 Wales Strippit of Canada Ltd. 86
165 Wall Colmonoy (Canada) Ltd. 88
166 Welwyn (Canada) Ltd. 20
167 Werner (Canada) Ltd., R. D. 70

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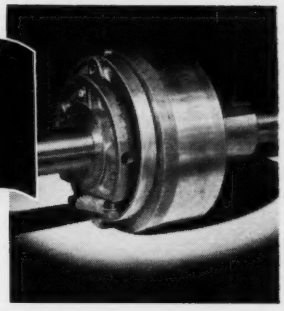

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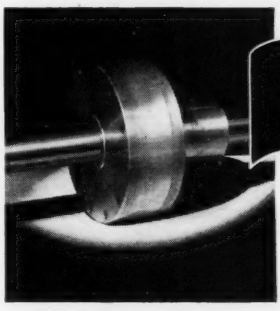

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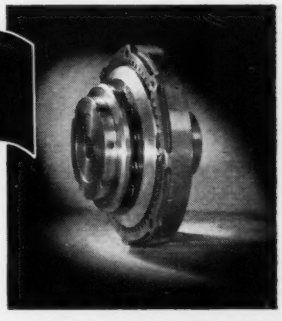
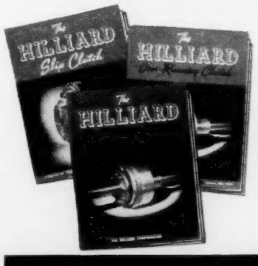


A reliable series of spring-loaded slip clutches and couplings. Rugged construction with ample friction surface for heavy-duty use. Outstanding for preventing overloads and shocks; for starting heavy loads; as tension drag brakes; for reeling and winding operations; and many other uses.



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Editorial

Come on! Make an effort this year

Nothing succeeds like success (or so they say) and this certainly seems to be borne out by the Design Engineering Show.

Held last year in Philadelphia (for the first time) it aroused such interest that, before the show ended, there was a rush for booths for this year's event.

In 1956 there were 180 booths. This year the number of bookings increased so much (to 375 booths) that the new Coliseum in New York had to be chosen for its venue. Twenty thousand are expected to attend.

Concurrently, the machine design division of the ASME will sponsor a conference on innovations in the design engineering field. Featured will be some 30 speakers, all top-rank design engineers.

A panel discussion, "Procedures in developing new designs," will occupy the entire first day. On the second day, a mechanical session will discuss new developments in the design and application of gearing and cams; another session will be on metallic materials, ceramics and refractories. "Selecting motors with new NEMA frame sizes" and "Static versus contactor controls" make up the electrical session.

On the third day, the mechanical session will discuss how to design parts for easiest machining, handling and assembly. The materials session will consider plastics and rubbers, coatings and finishes, whilst the electrical session will be devoted to numerical control for machinery and the design of machines for automatic controls.

So don't forget

The attendance of Canadian design engineers last year was most disappointing and so that people can't say they didn't know about it this year, we want to remind readers that the date is May 20 to 23. No one in the design field can afford to miss the show, for it covers a terrifically wide field of engineering: mechanical components; electrical components; materials (metallic and non-metallic); fasteners; finishes and coatings; hydraulic and pneumatic components; shapes and forms (yes, even some of those); and accessories.

William Morse.

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167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188

New Products and literature

200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221
222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243

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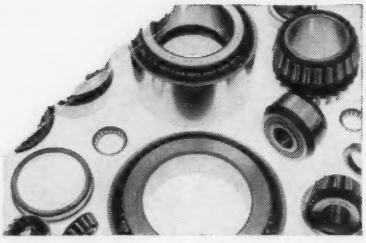
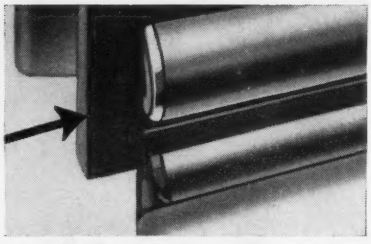
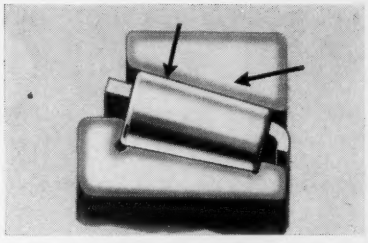


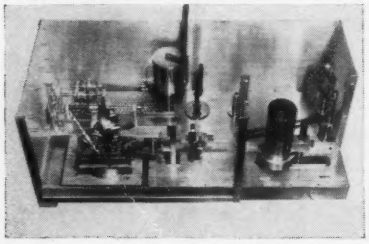
THERE ARE 27 TYPES of Timken tapered roller bearings. This wide selection means you get the bearing design exactly suited to your job. Whatever your bearing application problem, we can help solve it.



THE SOFT STEEL CAGE used in Timken tapered roller bearings separates the rollers, keeping them spaced evenly. This prevents scuffing of the rollers, adds to the bearing life and gives you more for your money.

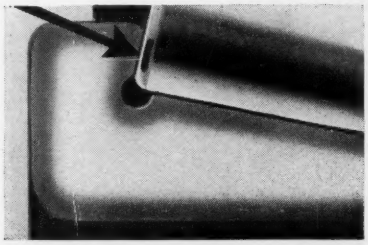


HARD ON THE OUTSIDE, tough on the inside. To take shock loads, give longer life, Timken bearing rollers and races are case-carburized to have a hard, wear-resistant surface over a tough, shock-resistant core.

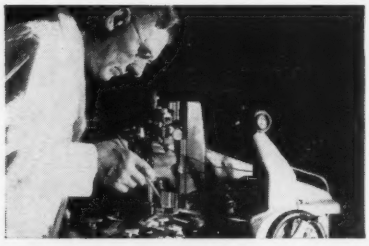


MICRO-INCH FINISH is standard for Timken bearings. This profilograph checks contours and smoothness of circular surfaces to a millionth of an inch, helps us make Timken bearings truer, quieter, longer-wearing.

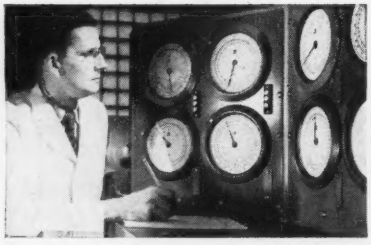
6,525 SIZES, the world's largest selection of tapered roller bearings. From bearings smaller than your finger to 71½" in inside diameter, the Timken Company can supply the size you need for any specific application.



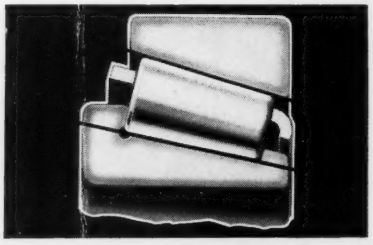
POSITIVE ROLLER ALIGNMENT is assured because the taper in Timken bearings holds ends of rollers snug against the rib. The taper in Timken bearings lets them take radial or thrust loads or any combination.



ACCURATE TO 50 MILLIONTHS of an inch. This Universal Measuring Machine checks gages and machine parts used to make Timken bearings. Our gage laboratory, one of the world's best equipped, helps make Timken bearings your No. 1 bearing value.



ONLY FINEST ALLOY STEEL is used in Timken bearings. This spectrometer helps control its quality—in 40 seconds gives the exact chemical analysis of a melt. In a few minutes, results are flashed to the melter. It's another step in rigid quality control.



FULL LINE OF CONTACT between Timken bearing rollers and races gives them *extra* load-carrying capacity. Get *all* these advantages. Specify "Timken". The Timken Roller Bearing Company, Canton 6, O., U.S.A. **CANADIAN PLANT:** St. Thomas, Ont. Cable: "TIMROSCO".

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FOR CANADIAN INDUSTRY